JANUARY 1950

INDUSTRY AND POWER

A Magazine
for Plant Engineers
and Executives

EASE
UTE
O

President	Gen. Mgr.	Superintendent	Plant Engineer	Chief Engineer	Power Engineer	Engineering Dept.	Electrical Dept.	Maintenance Dept.	Purchasing Dept.

TABLE OF CONTENTS PAGE . . . 5

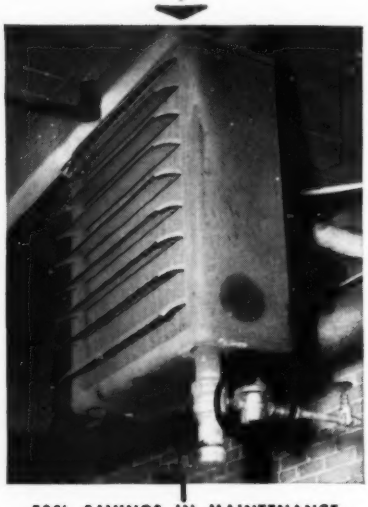
"You rarely have to repair <u>this</u> steam trap mechanism"

YOU SAVE TIME AND MONEY

THE Armstrong hardened chrome steel valve opens wide and closes tight — with a snap! This eliminates throttling and consequent wire drawing. The Armstrong free-floating lever mechanism is almost frictionless. The bucket and valve lever assembly are 18-8 corrosion resistant stainless steel. The mechanisms of Armstrong steam traps for low and medium pressures are identical in materials and workmanship to those used in Armstrong traps for pressures to 1500 psi, 900 F.

There is nothing in an Armstrong trap to bind, stick, collapse or leak. *Now is the time to quit working for your steam traps and buy the traps that will work for you.* Call your nearby Armstrong representative today.

ARMSTRONG MACHINE WORKS
820 Maple St., Three Rivers, Mich.



50% SAVINGS IN MAINTENANCE since installing Armstrong steam traps on the heating system at *John Deere Ottumwa Works, Ottumwa, Iowa.* This is typical of reports from Armstrong users.

THE 36-PAGE ARMSTRONG STEAM TRAP BOOK contains complete data on the design, operation, selection and installation of Armstrong steam traps for all services. Send for your free copy.

ARMSTRONG STEAM TRAPS

Supplying authoritative information on plant engineering—news of power and mechanical equipment, management, maintenance, industrial practices and developments, and associated subjects.

INDUSTRY AND POWER

A Magazine for Plant Engineers and Executives

VOLUME 58 **JANUARY, 1950** NUMBER 1

MAUJER PUBLISHING COMPANY

OFFICES: ST. JOSEPH, MICHIGAN

A. R. MAUJER, President
R. W. STRAUSS, Exec. Vice President
W. T. WATT, Vice President
C. L. SEAMAN, Vice President

Editorial Staff

A. R. MAUJER, Editor and Publisher
R. W. STRAUSS, Assistant Publisher
H. E. HOLLENSBE, Editor
W. E. POOLE, Associate Editor
R. A. MOLLER, Assistant Editor
B. MADDOCK, Western Editor
E. LAMBERT, Editorial Assistant

M. J. SANDERS, Promotion Manager
J. B. KLEIN, Circulation Manager
M. M. TYM, Production Manager

Editorial Advisory Board

A. A. POTTER,
Dean of Engineering and Director, Engineering Experiment Station, Purdue University
A. G. CHRISTIE,
Emeritus Professor, Mechanical Engineering Johns Hopkins University
WILLIAM STANIAR,
Consulting Engineer, Wilmington, Del.
G. W. KELSEY,
Vice-President, Builders Iron Foundry
E. J. KATES,
Consulting Engineer, New York
C. S. LEOPOLD,
Consulting Engineer, Philadelphia
R. J. S. PIGOTT,
Chief Engineer
Gulf Research & Development Co.
DAVIS M. DeBARD,
Vice President
Stone & Webster Service Corp.

REPRESENTATIVES

CHICAGO:
W. W. Brown
360 N. Michigan Ave.
DE 2-0351

NEW YORK:
C. L. Seaman
285 Madison Ave. (17)
Lexington 2-4672

CLEVELAND:
R. B. Rogers
P. O. Box 432,
Hudson, Ohio
(Hudson, Ohio 69)

PHILADELPHIA:
O. D. Young
34 St. Pauls Rd.,
Ardmore, Pa.
Ardmore 5552-R

LOS ANGELES:
Don Harway
Don Harway & Co.
1709 W. 8th St. (14)
DUnkirk 2-8576

Established May, 1920

Member Controlled Circulation Audit and National Business Papers Association

Distributed Exclusively to Buyers of Equipment in America's Best Plants

Copyright 1950, Maujer Publishing Co.

INDUSTRY and POWER, including INDUSTRIAL POWER, is published monthly at St. Joseph, Michigan. Accepted under the act of June 5, 1934, authorized August 31, 1942.

Technical and Industrial Articles

Apropos of Salesmen 6
A. R. Maujer, Editor and Publisher

Editorial—Sell Basic Economic Facts!!! 71
Thomas Roy Jones, President, ATF Incorporated

Crucible's New Boilers Operate Efficiently at 113% of Rating 72
C. H. Leatham, Jr. Project Manager, The Rust Engineering Co.

Condenser Systems Need Planning Too 75
Tyler G. Hicks, Engineer, Hicks Associates

Choice of Dust Collecting Systems Governed by Many Factors 78
Chalmer R. Cline, Asst. to President, American Wheelabrator and Equipment Corp.

Economical PF Improvement Requires Proper Equipment 83
R. Morgan Wilson, Industrial Power Div., General Electric Co.

Select Steam Traps for Specific Conditions 86
Thomas Trail

Experts in Many Fields Address 70th ASME Annual Meeting 89

Two-Man Shifts Operate Bluebonnet Power Plant 91
E. P. Wilson, Consultant, The H. K. Ferguson Co., Inc.

How to Get More from Supervisor Training 94
Edmund Mottershead, Edmund Mottershead Associates

Bryan, Ohio, Adds Another Diesel and Changes from 2 to 3 Phase 97
H. T. Wilde, Jr., Superintendent of Utilities

Calcium & MG in Water Determined Separately by New Method 99
A. O. Walker, Ph.D., and R. S. Robertson, National Aluminate Corporation

Fork Truck-Pallet System is Money-Maker for Whitney Blake 101
D. C. McKean, Purchasing Agent, The Whitney Blake Co.

Industry Sponsored Plan Develops Future Executives and Engineers 103
Earl O. Shreve, President, Junior Achievement, Inc.

Mid-Century Review-Forecast Forum Held by Westinghouse 105

Synchronous Motor Now Powers Nicholson File's Group Drives 107
O. E. Watson, Superintendent of Electrical and Maintenance Departments, Nicholson File Company, Anderson, Ind.

Features

New Equipment 9
New Bulletins 16
Readers' Guide 20
"How-to" Kinks and Hints 110
"Spot" News of Industry 112
Book Reviews 134
News of Men & Companies .. 136
We Gladly Give Credit to ... 171
Advertisers' Index 172

Cover Illustration

American engineering know-how and ingenuity have been responsible for building the world's largest export market in the heavy machinery field. Here a rigger in one of the nation's largest industrial plants starts the head cover of a hydraulic turbine on its way to final assembly. The machine is destined to help harness the natural resources in areas now under development in some foreign country. Color photograph by courtesy of The National City Bank of New York.

Here 'tis! A different name for your old friends . . .

PROTO TOOLS -formerly PLOMB TOOLS

• You will find tools for every need in the complete line of PROTO tools — formerly Plomb tools. During the past year alone 138 new and 42 reinstated items were added to this famous line. And 232 existing tools were improved — aiming for ever higher quality. To be sure of getting the finest and most up-to-date tools to meet changing requirements, standardize on PROTO. Buy them from your dealer today.

WRENCHES • PLIERS • PUNCHES • CHISELS • SCREWDRIVERS
SOCKETS & HANDLES • PULLERS • TOOL BOXES • SPECIAL TOOLS

Write for catalog to PLOMB TOOL COMPANY
2276T SANTA FE AVE., LOS ANGELES 54, CALIF.

PROTO TOOLS
REG. U.S. PAT. OFF.
Professional Quality
LOS ANGELES
MADE IN U.S.A.
4991

Apropos of—

Salesmen

THE development of the art of writing and, later, printing, enabled men to accomplish two things: to communicate with each other while not face to face; to preserve ideas and facts.

The fullest use of writing was not made until comparatively recent times. I have reference to research. Research is not history; it is not experiment. It is a sort of amalgam of the two. In research, in its purest form, we take the facts of history and, with them as a basis, we experiment to uncover additional hitherto unknown facts.

Research involves the assembly of useful facts from whatever source. The plant engineer with the almost infinite problems with which he struggles stands sorely in the need of research.

A great reservoir of research material is the salesman. Yet we know from research of our own that the engineer is not using this source to the extent he could and should.

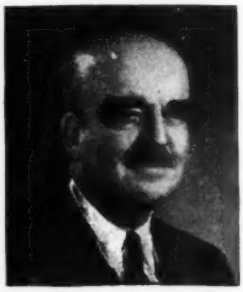
Last summer we were particularly interested in the subject of power transmission. Members of our staff made personal calls on men in 146 typical plants, located in 46 cities and towns, in 9 states. It was a comprehensive survey.

We learned some revealing things. For instance, take the one item of chain drives. We inquired into the reasons for selecting chain as a driving medium. Thirty-six answers were returned to the question: Why was chain selected? Sixteen different reasons were given. Of the 36 answers only 2 cited efficiency. In no instance was the ability to pull heavy loads mentioned. Yet this latter is one of the two chief characteristics of chain drives. No reference was made to the usefulness of chain for rugged service; in corrosive atmosphere, etc. No mention was made of the comparatively low first cost or the adaptability to short centers.

When it came to other types of drive (direct-connected, gears, V-belt, etc.) there was a similar lack of full knowledge of their advantages for specific applications.

Yet all of this knowledge is old stuff to the salesman. He is a walking encyclopaedia of research.

As an easy access to research the salesman is tops. He is familiar with all sorts of situations in the field with which he is identified. He has the research department of his own organization at his back.



All engineers will do well to lend an attentive ear to the salesman who knows his stuff. It isn't difficult to identify him and he can be of great help.

Every salesman should be given at least one fair interview. Those salesmen who obviously "know their stuff" should be encouraged to come again and the best chair in the office should be dusted off for them. They will repay you for the time and attention you grant them.

A. R. Mayer

Editor and Publisher

Fa628.5
Ind2S

187,000 CUBIC FEET OF AIR PER MINUTE is this large fan's maximum capacity . . . size: 16 feet high, 12½ feet wide, 9½ feet deep — weight, 15,800 pounds. It is now operating in a woolen mill down South.

BUILT HEAVIER THAN COMMON PRACTICE, Clarage units — both large and small — are equal to the most severe conditions you can imagine in connection with air handling or conditioning installations.

SEE OUR CATALOG IN SWEET'S

EQUIPMENT for many of the biggest, most important air handling jobs in this country is furnished by Clarage. Through the years architects, engineers, contractors, users have come to rely on Clarage equipment for long time service at operating and upkeep costs surprisingly low. May we work with you on your next project in our field?

CLARAGE
FAN COMPANY
Kalamazoo, Michigan

APPLICATION ENGINEERING OFFICES . . . . . IN ALL PRINCIPAL CITIES

HEADQUARTERS for Air Handling and Conditioning

DEPOSITORY

1311289

JENKINS PRACTICAL PIPING LAYOUTS 46

How to plan a CLOSED FEEDWATER HEATER SYSTEM

The principal application of Closed Feedwater Heaters is in regenerative stage heating of boiler feedwater in steam power plants. They are also used widely in industrial buildings, schools, hotels, hospitals and other institutions to heat the service water.

When used to raise the temperature of boiler feedwater with exhaust steam, bleed steam or live steam as the heating medium, the Feedwater Heater is usually the closed type (as in layout).

Some of the steam passing through a power plant turbine is withdrawn at various stages and goes into its own Feedwater Heater. Here it gives up its latent heat, condenses and passes into a deaerator. From the deaerator, which is at atmospheric pressure, feedwater goes to the boiler feed pumps where the pressure is raised to that of the boiler. It then passes, at about 210°F., through a Closed Feedwater Heater (like the one shown) to be heated to the highest practicable temperature.

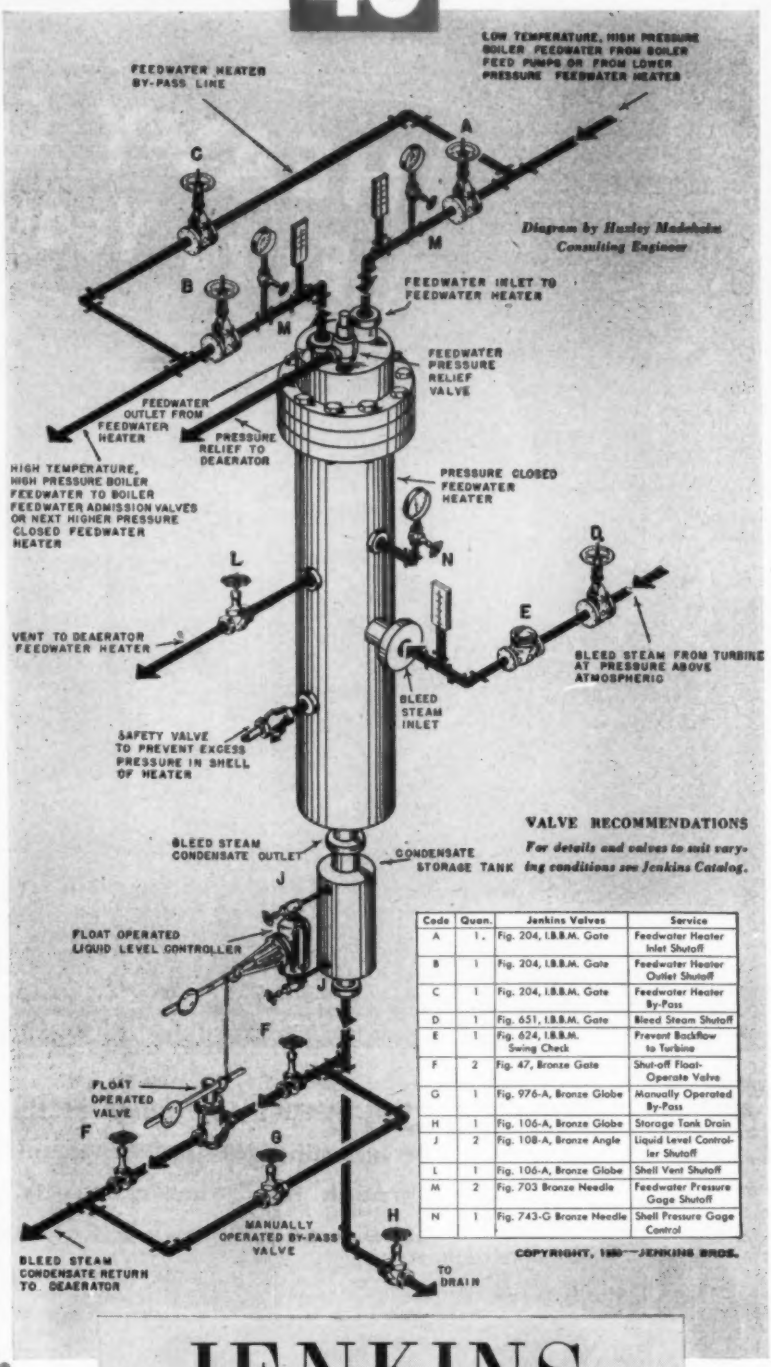
Consultation with accredited piping engineers and contractors is recommended when planning any major piping installation.

A CHOICE OF OVER 500 VALVES

To save time, to simplify planning, to get all the advantages of Jenkins specialized valve engineering, select all the valves you need from the Jenkins Catalog. It's your best assurance of *lowest cost in the long run.*

Jenkins Bros., 80 White Street, New York 13; Bridgeport, Conn.; Boston; Philadelphia; Chicago; San Francisco; Atlanta. Jenkins Bros., Ltd., Montreal.

NEW BOOK OF PIPING LAYOUTS, Nos. 26 to 50
A new book of Jenkins Practical Piping Layouts — Nos. 26 to 50 — including above, is in preparation. Mail coupon to get your copy when ready.


LOW TEMPERATURE, HIGH PRESSURE BOILER FEEDWATER FROM BOILER FEED PUMPS OR FROM LOWER PRESSURE FEEDWATER HEATER
FEEDWATER HEATER BY-PASS LINE
Diagram by Huxley Madeheim Consulting Engineer
FEEDWATER INLET TO FEEDWATER HEATER
FEEDWATER PRESSURE RELIEF VALVE
FEEDWATER OUTLET FROM FEEDWATER HEATER
PRESSURE RELIEF TO DEAERATOR
HIGH TEMPERATURE, HIGH PRESSURE BOILER FEEDWATER TO BOILER FEEDWATER ADMISSION VALVES OR NEXT HIGHER PRESSURE CLOSED FEEDWATER HEATER
PRESSURE CLOSED FEEDWATER HEATER
VENT TO DEAERATOR FEEDWATER HEATER
BLEED STEAM FROM TURBINE AT PRESSURE ABOVE ATMOSPHERIC
BLEED STEAM INLET
SAFETY VALVE TO PREVENT EXCESS PRESSURE IN SHELL OF HEATER
BLEED STEAM CONDENSATE OUTLET
CONDENSATE STORAGE TANK
FLOAT OPERATED LIQUID LEVEL CONTROLLER
FLOAT OPERATED VALVE
MANUALLY OPERATED BY-PASS VALVE
BLEED STEAM CONDENSATE RETURN TO DEAERATOR
TO DRAIN
A
B
C
D
E
F
G
H
J
L
M
N
Q

VALVE RECOMMENDATIONS

For details and valves to suit varying conditions see Jenkins Catalog.

Code	Quan.	Jenkins Valves	Service
A	1	Fig. 204, I.B.B.M. Gate	Feedwater Heater Inlet Shutoff
B	1	Fig. 204, I.B.B.M. Gate	Feedwater Heater Outlet Shutoff
C	1	Fig. 204, I.B.B.M. Gate	Feedwater Heater By-Pass
D	1	Fig. 651, I.B.B.M. Gate	Bleed Steam Shutoff
E	1	Fig. 624, I.B.B.M. Swing Check	Prevent Backflow to Turbine
F	2	Fig. 47, Bronze Gate	Shut-off Float-Operate Valve
G	1	Fig. 976-A, Bronze Globe	Manually Operated By-Pass
H	1	Fig. 106-A, Bronze Globe	Storage Tank Drain
J	2	Fig. 108-A, Bronze Angle	Liquid Level Controller Shutoff
L	1	Fig. 106-A, Bronze Globe	Shell Vent Shutoff
M	2	Fig. 703 Bronze Needle	Feedwater Pressure Gage Shutoff
N	1	Fig. 743-G Bronze Needle	Shell Pressure Gage Control

COPYRIGHT, 1950—JENKINS BROS.

JENKINS BROS., 80 White St., New York 13, N. Y.

Reserve copy of New Piping Layout Book for

Name.....

Company.....

Address.....

.....

JENKINS
LOOK FOR THE DIAMOND MARK
VALVES
SINCE 1864
TRADE JENKINS MARK
Jenkins Bros

NEW EQUIPMENT & DEVELOPMENTS

For Additional Information Concerning These Latest Developments in Power and Plant Equipment, Applications, Materials, Method and Processes Use One of the Convenient Reply Cards on Page 37. Circle the Numbers of Items in Which You Are Interested.

301—TUBE PROVIDES DUST COLLECTOR EFFICIENCY

A longer tube of small diameter which has just one carefully proportioned inlet slot for flue gases, forms the basis for a new tubular dust collector. By introducing the gases in a

deep, narrow ribbon, this new inlet slot materially reduces the horizontal distance a particle must travel before meeting the precipitating wall. The center outlet tube has been reduced in size to more closely approximate the center of the dust-free vortex produced by the whirling gases in the cyclone. In this collector the tubes are nested close together, so that gases are guided to the inlet slot by the contour of the adjoining tube which sets up an "S" shaped path. This path improves aerodynamic flow of the gas, and results in greater collection efficiency and the use of fewer tubes to handle a given quantity of gas. Prat-Daniel Corporation.

302—NEW DIESEL DRIVE USED ON PORTABLE AIR COMPRESSOR

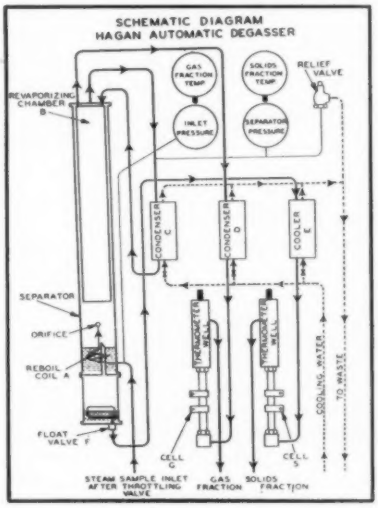
For users who prefer full Diesel-engine drive for their portable compressors, a new 500 cfm mobile-air has been announced by Ingersoll-Rand Co. The engine starts easily as a low-compression gasoline engine and after a short warm up period is shifted to full

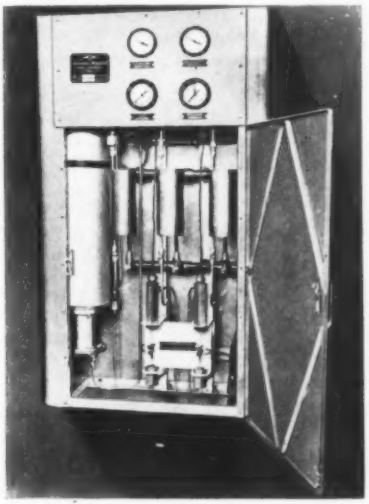
Diesel operation by means of a single lever. A new floating-speed regulator slows down the compressor to the lowest practical working speed that com-

(Continued on Next Page)

303—INSTRUMENT AUTOMATICALLY DETERMINES STEAM PURITY

A new device, designed primarily for use in determination of steam purity, is announced by Hagan Corporation. Instrument continuously and automatically provides an approximately 50-50 split of a flowing steam sample—one fraction of the condensed steam containing any dissolved solids that may be present, and the other any dissolved gases. The fraction of the condensed steam sample which contains dissolved solids free from gases is run through a cell in which its electrical conductivity is measured, and provides an accurate indication of steam purity because the influence of gases on conductivity is eliminated. A second cell is provided to measure the conductivity of the gas fraction. Both the solids fraction and the gas fraction can be diverted for chemical analysis. A graphic record may be obtained of both the solid and gas fraction. The principal advantage is the new degasser's automatic operation. Installation is easy and simple and requires little in the way of connections. Steam demand is about 30 lb per hr. The flowing steam and condensate contact only stainless steel in this unit and contaminating materials are not picked up. The time interval from entrance of steam into the degasser to passage of the degassed condensate out of the conductivity flow cell is short—approximately one minute. This means that the plant operator can readily correlate recorder charts made in conjunction with the degasser with steam flow, superheat temperature, or other operating charts to obtain a coherent over-all picture of conditions. This lag is a result of the very low fluid holdup in the degasser, and the use of a flow cell with a small chamber. The complete device weighs approximately 90 lb and is bound in a metal cabinet 40 x 24 x 9 in.

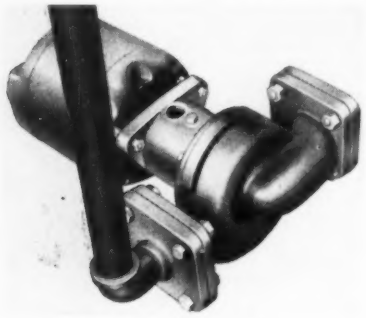




presses just enough air to hold the pressure. This results in greater fuel savings and higher average air pressures. Full 500 cfm capacity is delivered at rated 100 psi pressure. Other features include two-stage air-cooled compressor, hydro-shifted flex-disc clutch, channel valves, and running gear and mountings.

304—HOT WATER CIRCULATING PUMP DISTRIBUTES HEAT

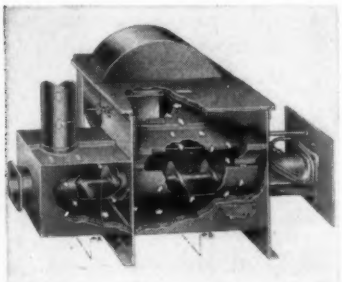
New hot water circulating pump is adapted especially for panel and radiant heating and circulating hot water in industrial plants and large buildings. Special features are: utilizes a heavy duty type mechanical seal to assure positive protection against leak-



age; and smooth and quiet operation is obtained by the use of a molded rubber shaft coupling. The pump is small, compact and can be installed in either vertical or horizontal position. The pump is also available in sizes from 1 in. through 2½ in. and is said to warm even the remotest rooms and do it faster, reduce fuel consumption and help reduce calcification in the pipe lines. Fairbanks, Morse and Co.

305—DRYER PREHEATS COAL BEFORE BURNING

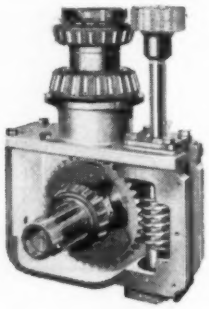
A compact efficient coal dryer is now being built in as standard equipment on all Iron Fireman Mfg. Co. spreader stoker units. A mixture of air and furnace gases is used for dry-



ing and preheating the coal. This mixture enters the dryer at a temperature of approximately 1000° F and moves counterflow through the unit. Due to the high rate of heat transfer in the dryer, the temperature of the gases is reduced before entering the conveyor fan. The dryer, fan, and conveyor housing are insulated, and the insulation is protected with an outer steel casing. In passing through the dryer, the coal is sufficiently preheated to reduce the time required for ignition after it enters the furnace. Without preheating, a much larger percentage of the fine coal would be carried over into the boiler passages without being burned. The more effective preheating of the coal also increases combustion efficiency and responsiveness to load demands.

306—DIFFERENTIAL DRIVE PROVIDED FOR HAND TRUCKS

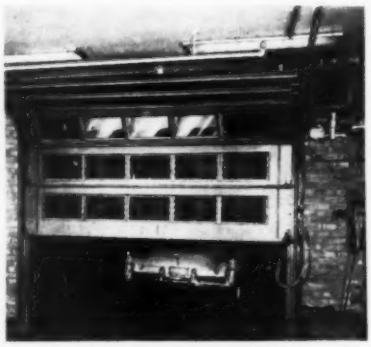
Differential drives on all model "K" front wheel drive type motorized hand lift trucks has been announced by Lift Trucks, Inc., Cincinnati, Ohio, that insures substantial operating and maintenance economies to fleet operators. The chain drive with the continual



maintenance problems it presents is completely eliminated. Easy steering of the truck is made possible by the differential action, even when the truck is stopped. The wheels can be turned with the handle in the vertical position —an important factor in view of the narrow aisles and close quarters in which trucks are operated. All gears and running parts are sealed in lubricant for low maintenance cost and long life.

307—DOOR ADMITS FILTERED AIR IN PAINT-SPRAY ROOMS

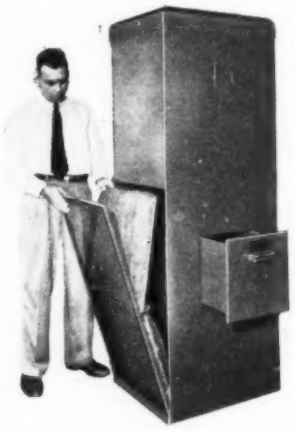
An improved type of closure for paint-spray rooms and other work areas where air is subject to high spray or powder content has recently been added to the line of sectional, all-metal doors made by The Kinnear Manufacturing Co. The new door features rows of standard, furnace-type, spun-glass filters in each panel which permits a continuous supply of clean, fresh air to circulate into the room. When the door is closed any air escaping from the room is also filtered. Heavy-duty torsion-spring counterbalance is included, and the door operates on ball-bearing rollers moving in steel tracks that raise the door to a horizontal position overhead. An exhaust fan at the opposite end of the paint-spray room keeps fresh air circulating constantly through the room so masks are no longer required. The use of suitable baffles in front of the fan do



away with air turbulence or direct currents, promoting an even, draft-free exchange of air throughout the room. Exhaust fans can be arranged to turn on automatically as the door is closed, and to switch off as the door is opened.

308—DUST COLLECTORS MEET EXPANDING NEEDS

New heavy duty portable dust collectors can be set up anywhere to serve one or several machines for any period of time . . . or can be readily moved to meet changing needs. The collectors eliminate long, pipe runs to remote areas of a plant where one or



a few machines are located. The units handle dust from grinding, buffing, and polishing metal-working machines and similar dust sources. Each unit consists of motor, exhauster, centrifugal pre-cleaner, and steel wool filter after-cleaner. In all sizes of this collector the dust laden air is delivered to a small diameter high efficiency, centrifugal pre-cleaner where all but

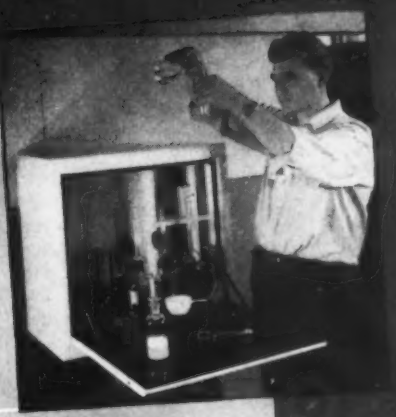
(Continued on page 12)

Nalco

OF

WATER TREATMENT

Backs Your Routine Plant Testing....



Spectrographic analysis of boiler sample in the Nalco Laboratories

with Scientific Laboratory Analysis

NATIONAL ALUMINATE CORPORATION

6218 West 66th Place
Chicago 38, Illinois

Canadian inquiries should be addressed to Alchem, Limited, Burlington, Ontario

NALCO System service does not stop with your original plant survey and chemical treatment recommendations . . . One of the principal reasons Nalco System plants *continue* to get water treatment results, year after year, is that Nalco field and laboratory service back routine plant testing and control procedures with careful analyses and regular surveillance of all conditions relating to your overall water treating problems.

Permanent water treatment security with The Nalco System can be started promptly at your request. Call your Nalco Representative today — or write direct.

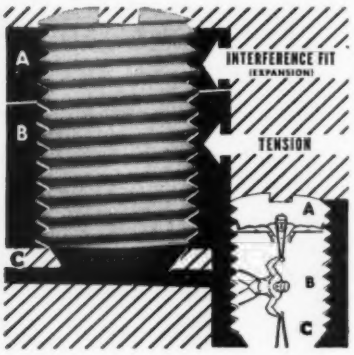
THE Nalco SYSTEM • **Serving Industry through Practical Applied Science**

(Continued from page 10)

the finest particles are removed. The air then passes through steel wool filter pads, three inches thick, for final cleaning. Motor and exhauster are completely isolated from dust, and the units are completely fire proof with extra heavy housings. Exhausters are heavy dust industrial type, direct connected to a 3600 rpm, 220/440 v motor. The Kirk & Blum Mfg. Co.

309—SET SCREW IS SELF-LOCKING

A new self-locking set screw and adjusting screw, that does not require any lock nuts, wires, impinging locking screws, deformed or riveted threads, is announced by Set Screw & Mfg. Co. The screw is specifically designed for applications where excessive vibration is a factor, and for regulating and adjustment applications, in which instantaneous locking at a precise point is desired. Described as



having triple-locking action, the screw has a combination of interference fit, tension, and the locking of the set screw against the shaft or other part. As the cutaway illustration shows, the lower part of the screw (B) which enters the hole first, has a standard thread, the same as any other screw. The upper section of the screw, (A) designated as the "activating area" has a larger pitch diameter of the thread section which creates an interference fit or expansion effect against the thread flanks. This results in a tension or opposed-force action, causing the thread section of the upper part to be drawn downward and that of the lower part to be drawn upward in the direction of the screw's locking action against the shaft.

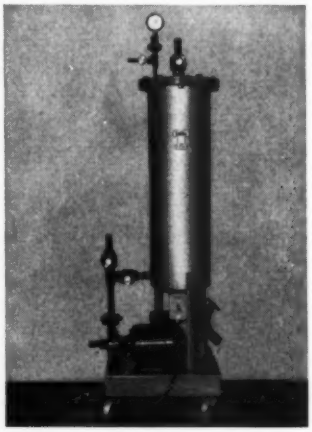
310—CLUTCH MECHANISM STARTS AND STOPS POWER

Devised for starting and stopping the flow of mechanical power a clutch mechanism has been announced by The Edgemont Machine Company. The mechanism is installed between motor and driven machine, and may be engaged and disengaged at any time. The new design incorporates an extended bronze bushed sleeve, tapered on the outside diameter to fit the tapered bore

of the sheave. To assemble the sheave on the sleeve, it is necessary only to remove the grease fitting, place the sheave over the taper, and use the standard sheave pull-up bolts to draw the sheave snugly into place. To demount the sheave, the same bolts are used as jack screws in the taps provided for that purpose.

311—NEW UNITS CAN FILTER LIGHT SOLUTIONS

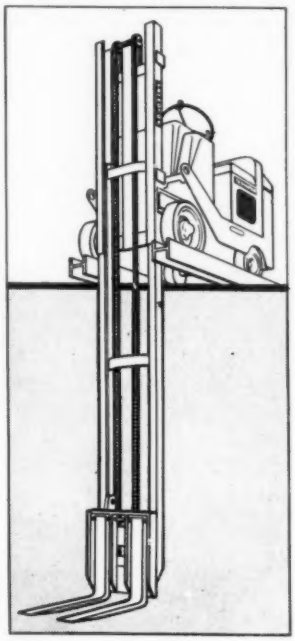
Especially adapted to the filtering of light solutions, a series of new units contain all the features of regular filters, but are produced at minimum cost. No replacement parts such as bags and pads are necessary and filtering is accomplished by an aid supported by rigid membranes of wire-mesh or porous stone. In addition, the units are cleaned by a backwash system, without taking the machine apart and without handling



the sludge in any way. Available in plain steel, rubber-lined steel, and type 316 stainless, these filters operate efficiently with both cyanide and acid solutions. Chamber capacities are: 1 sq ft (delivers 400 gph open pumping); 3 sq ft (delivers 560 gph); 4½ sq ft (delivers 1,020 gph); and 9 sq ft (delivers 2,280 gph). Standard equipment includes filter chamber, pump, motor, motor starter, and all valves and fittings, assembled on a portable platform. Titeflex, Inc.

312—LOADS RAISED TO BALCONY WITH FORK LIFT TRUCK

Engineered to lower and raise heavy loads between balcony storage areas and first floor production lines a new "elevator" fork lift truck has been announced by Towmotor Corporation. The truck is believed to be one the first developments of its kind. A special non-tilt mast and carriage assembly were designed to permit the load carrying forks to be lowered 98 inches

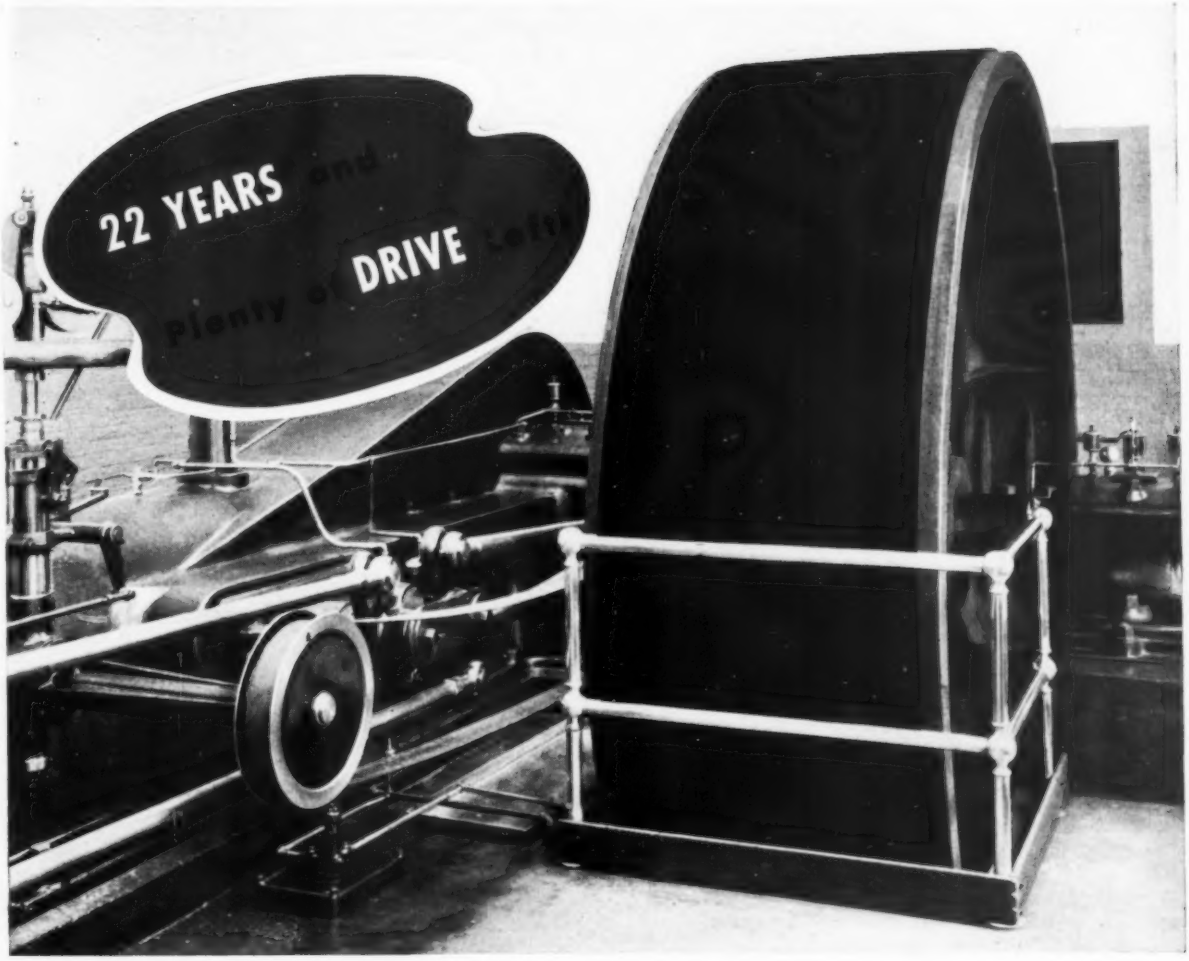


below balcony floor level. Mounted on a standard Towmotor fork lift truck, the elevator unit has a lifting and lowering capacity of 2,000 lb. Full capacity loads can be lifted from first floor to 10 in. above balcony floor level. The "elevator" truck can be built in various capacities and heights-of-lift.

313—CHANGE GAS BURNER TO OIL OR STOKER

Changeover from gas to oil firing in a matter of minutes is possible with a new series industrial gas burner produced by Iron Fireman Manufacturing Co. The burner can also be changed to stoker firing. The furnace mounting plate on the industrial type gas burner, which is designed to burn natural or mixed gas, is provided with lugs to which the oil burner can be

(Continued on page 14)



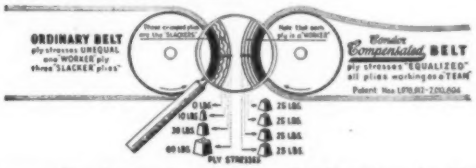
One of Many *Condor* Transmission Belt Records

This 38", 10-ply Condor Transmission Belt has worked continuously for 22 years in the engine room of J. L. Prescott Company, Passiac, N. J. It is still going strong and looks good for several more years before being retired.

This example of Manhattan belt workmanship is one of many records set by Condor Transmission Belts. Pioneer developments in belt construction have come out of Passiac for more than 56 years . . . and new Manhattan developments continue to benefit industry.

MANHATTAN'S PATENTED PRINCIPLE OF EQUALIZED PLY STRESSES

Typical of the constructions that give you longer belting service is the CONDOR COMPENSATED BELT. The Compensated Principle insures that all plies in the belt pull their equal share of the load. There is no crinkling, loafing, or overloading of some plies rounding the pulleys. The diagram illustrates the principle of Equalized Ply Stresses. This lengthens fastener life 3 to 4 times and prevents outer ply rupture, two common failures in transmission belts.



Rely on Raybestos-Manhattan Engineering in Rubber to improve *your* power transmission economy. Condor Whipcord Endless Belts, Condor Whipcord V-Belts and Ray-Man V-Belts for rough, tough drives are also exclusive Manhattan constructions. Only Raybestos-Manhattan makes a complete range of transmission belts: duck, cord, endless, four selections of driving surfaces, oil-proof, non-spark, acid-proof.

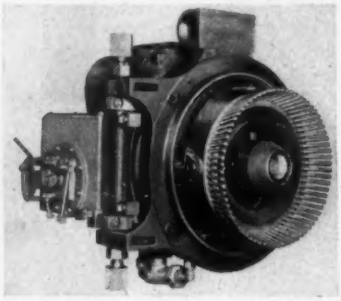
Keep Ahead with Manhattan

MANHATTAN RUBBER DIVISION — PASSAIC, NEW JERSEY

RAYBESTOS-MANHATTAN, INC.

Manufacturers of Mechanical Rubber Products • Rubber Covered Equipment • Radiator Hose • Fan Belts • Brake Linings • Brake Blocks • Clutch Facings • Packings • Asbestos Textiles • Powdered Metal Products • Abrasive & Diamond Wheels • Bowling Balls

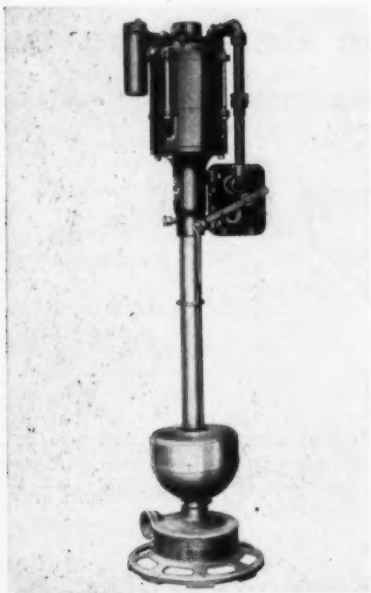
(Continued from page 12)
mounted, if desired. An adapter can also be provided for mounting a boiler front sleeve for the pneumatic spreader stoker. This arrangement makes possible a combination gas and oil burner or a gas and spreader stoker combination. The burner will operate equally



well with either natural or forced draft. When installed for natural draft conditions the refractory ring is installed so that the gas burner will induce most of the air required for combustion; however, when the burner is installed in combination with the spreader stoker, forced air is used and is provided by the undergrate fan.

314—SUMP PUMPS ARE EXPLOSION-PROOF

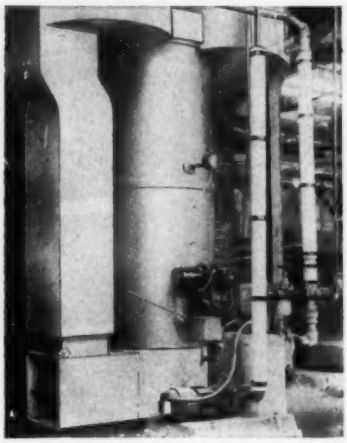
A new sump pump, announced by Penberthy Injector Company has a fully enclosed and explosion-proof motor and switch with Underwriters' approval for hazardous locations. Motor leads are connected to switch termi-



nals through threaded conduit and switch housing has ½ in. pipe size threaded outlet for connection to line. Pump has a nominal capacity of 4,000 gal per hr and will operate against a 23 ft discharge head. Construction is copper and bronze throughout. The switch is particularly adapted to float operation and is controlled by a copper float which slides on the supporting column. An adjustable stop governs water level at which the pump starts and stops. Pump is built in 5 lengths for sump depths of 2, 3, 4, 6, and 8 ft. All lengths are available for 110 v, 60 cyc, or 220 v, 60 cyc current.

315—HEAT UNIT DESIGNED FOR PROCESS DRYING

A new model of a self-contained direct fired industrial heating unit for drying any material requring temperatures up to 500° F has just been announced by Prat-Daniel Corporation. Primary unit is a gas or oil fired



heater of 300,000 or 550,000 Btu's per hour, with forced air circulation. This model is designed to recirculate its air until the desired temperature is reached, then discharges continuously at the temperature required.

316—CONTROL VALVES HANDLE CORROSIVE FLUIDS

Designed primarily to handle corrosive fluids or gases or any slurry or fluid carrying solids in suspension which would plug the bowl of a double seated control valve or lodge in the guide section of a venturiflo (angle) valve are diaphragm control valves available for any size up to 12 in. The valves are also useful on many vacuum applications and are packless as a rubber or other plastic diaphragm is retained between the bonnet and valve body. The body is streamlined with no pockets and has a transverse weir. A compressor or foot is attached to the upper side of the valve body diaphragm. Tight shutoff is obtained when the diaphragm is brought firmly in contact with the weir. Throttling control is a function of the distance of the diaphragm from the weir. Its flow characteristic is substantially linear. The valves can be supplied for normally open, normally closed or "on" and "off" action. The deep diaphragm case of the valves assure full lift and

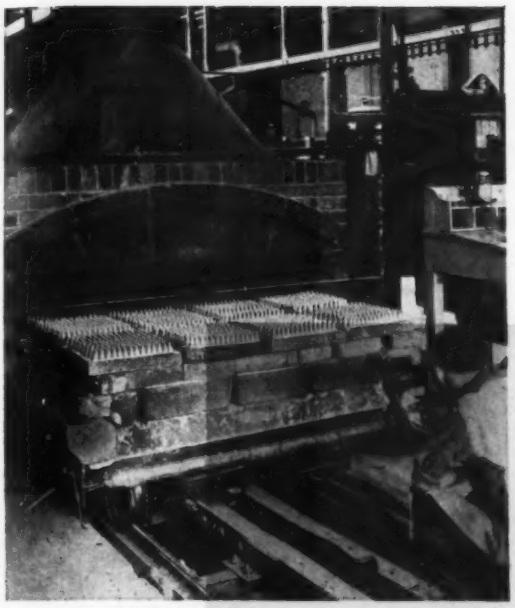
100% capacity on all size bodies. The valves are equipped with a valve stem position indicator to show percentage opening. Hammel-Dahl Company.

317—BLADELESS TRASH PUMP HANDLES SEWAGE

Pumping unit for handling trash and sewage is different in that its impeller is bladeless, having no vanes or blades on which trash and other fibrous material can catch. Instead the fluid passes through the impeller through a single rotating channel or passage way with the centrifugal force doing the work. Wound somewhat

like a corkscrew, this curved channel starts at a small radius at the axis of rotation and then fans outward in a helical path. Thus centrifugal action

(Continued on page 141)



How to Use "dag" Colloidal Graphite for 141 industrial purposes

READ the NEW Acheson Bulletin #424 on the subject **"dag"** colloidal graphite for industrial lubrication.

"dag" colloidal graphite is unique in its *combination* of uses and properties. It is **slipperier than oil . . . perfect for assembly** and run-in, and for high temperature applications. **It clings and endures** . . . the ideal rugged lubricant. It lubricates oven car wheels and hot conveyors. **It is** chemically inert . . . supplies solvent-resisting dry films for degreaser conveyors and alkali washers, reduces corrosion and galling.

But these suggestions merely hint at the wide scope of **"dag"** colloidal graphite. Dry films of graphite produced from solvent and solvent-binder dispersions are especially useful. **"dag"** colloidal graphite can be incorporated into your present lubricants. Get your own ideas . . . see the current list of uses and get the NEW Bulletin #424 on **"dag"** colloidal graphite for Industry. If you like, ask to see an Acheson engineer, experienced in finding new and cost-saving ways to use **"dag"** colloidal graphite.

Acheson Colloids is equipped to do custom disintegrating, dispersing, and stabilizing of solids in a wide variety of vehicles. The dispersing of colorants in resins and plasticizers is one of our specialties. If you are in need of this type of service, tell us about it. We may be able to help you.

ACHESON COLLOIDS CORPORATION
Port Huron, Michigan

☐ Send me the NEW Bulletin #424
☐ Send me the "List of Industrial Uses"
☐ Send an Acheson engineer

NAME.....

COMPANY.....

STREET.....

CITY..... ZONE.....

STATE..... A-17

dag DISPERSIONS

Acheson Colloids Corporation, Port Huron, Michigan
. . . also Acheson Colloids Limited, London, England

NEW BULLETINS

Copies of the listed booklets, which are the very latest published by leading equipment manufacturers, may be obtained by using the convenient postage-free cards on page 37. Circle the letter corresponding to the one shown in the item.

BOILERS, AUXILIARIES, ACCESSORIES

Gas Burners (A) Informative four page folder contains operating data on six sizes of industrial gas burners and combination gas and oil burners. Specifications for each size burner is listed. A typical control diagram and suggested burner installation is shown. Iron Fireman Manufacturing Co.

Combustion Control (B) Three basic elements, which are contained in an automatic combustion control system, are clearly explained in an eight page bulletin just released. Photographs illustrate the many adaptations of the control to assure maximum combustion efficiency and minimum smoke. General Power Plant Corporation.

Combustibles (C) Drawings and photographs explain in a new 16 page bulletin now being distributed, the operation of an electronic type instrument which operates on the catalytic combustion principle. Typical applications to boiler furnaces, atmosphere producers, rotary kilns, industrial furnaces, and chemical processes are illustrated. Bailey Meter Co.

Smoke (D) An economical and scientific method to combat smoke evil as well as provide fuel saving by cleaner and more efficient combustion is depicted by sketches in an 8 page bulletin. Information on savings effected is also given. Delta Engineering Company.

PRIME MOVERS: DIESELS, TURBINES, COMPRESSORS

Multi-Stage Turbine (E) Catalog contains a discussion of the economics of by-product power. Basic types of turbines for different operating conditions and applications up to 20,000 horsepower are listed. Several pages of photographs are devoted to design features and series of cut-a-way diagrams show various governing and control systems. De Laval Steam Turbine Company.

Radial Diesels (F) New publication describes and illustrates a new two-cycle, 11 cylinder, 14 x 16 in. radial engine which develops 1800 hp at 400 rpm, or 1250 kw. Included in the illustrations are sectional views of the crankshaft and gear assembly plus a cross-section view of the engine that shows the pressure lubrication and piston cooling system. Nordberg Mfg. Company.

Diesel Engines (G) Two new bulletins contain complete specifications for six automotive and industrial model Diesels adaptable for highway and off-highway automotive applications as well a wide range of industrial and power units. Each bulletin includes general specifications; photographs of the various models; and drawings of torque horsepower, and fuel consumption curves. Cummins Engine Co.

Lubrication (H) Problems of oxidation, emulsification, foaming and sludging, as related to turbine lubrication, are discussed in a 4-page folder entitled "Turbo-Drive", recently issued. Also included in this two-color folder are sections describing proper flushing of turbine systems and features of fortified turbine oil. E. F. Houghton & Company.

Heat Exchangers (I) Six page bulletin is available describing savings on initial cost, on delivery time, and maintenance of heat exchangers. Tables of sizes, dimensions, and weights are included as well as drawings showing single and two pass types. Chart of capacities is given as well as description of the advantages. Young Radiator Co.

WATER AND LIQUID TREATMENT

Water Hardness Test (J) Technical paper entitled "Total Hardness in Water by Direct Colorimetric Titration" explains thoroughly a quick and accurate method of testing water hardness by titration into an indicator—which is red in the presence of calcium and magnesium ions, and blue in their absence. Samples can be analyzed to 0.1 ppm in a range of 0.0—2.0 ppm. W. H. & L. D. Betz.

Cold Process Softener (K) Just released 16 page bulletin explains how this cold process slurry type precipitating water softener and coagulator operates. Each of the component parts —chemical mixer, softener and coagulator tank, and filter—are discussed and illustrated. A two page flow diagram illustrates method of installation sequence. Worthington Pump and Machinery Corporation.

Additive (L) In addition to describing the physical composition of a fast acting fuel oil additive, how it functions during operation of the system, and the results obtained, a revised and enlarged 6 page folder features many photographs, including enlarged microphotos actually showing the additive as it disperses sludge deposits. Another additive for emulsifying free water in the fuel oil system is also described in this 2-color folder. E. F. Houghton & Co.

Aftercoolers (M) Tables, charts, and typical installation diagrams show dimensions and advantages of pipe line aftercoolers and cyclone separators in a four page folder available upon request. The aftercooler is described as an efficient counter-current heat exchanger designed to reduce temperature of compressed air to within 10° of the cooling water. The cyclone separator completes the job of removing condensed moisture and oil from the air stream. R. P. Adams Co., Inc.

Sludge & Slag (N) An attractive two-color bulletin describes a scientific combination of chemicals that are especially compounded to act upon and reduce residual deposits of combustion found in all types of boilers using coal, coke, oil, or waste fuel. Also described is a fuel oil treatment for the elimination of sludge and moisture in fuel oil storage tanks, pipe lines, pre-heaters, and the entire fuel oil system. Consolidated Engineers, Co., Inc.

Deaerating Heaters (O) Bulletin outlines principles of deaeration and fully describes the design, operation, and applications of deaerating heaters and explains their distinctive features. Both vertical and horizontal types of heaters are shown, and the illustrations include flow sheets of this type of apparatus in conjunction with other feedwater equipment in intermediate pressure, high pressure, and central station boiler plants. Graver Water Conditioning Co.

Degasifier (P) Degasifying and vacuum storage systems for oil-filled cable, dielectric oils in X-ray tubes, refrigerator lubricating oil, and other

(Continued on page 154)

RUST can be stopped

. . . stopped easily, surely, economically!

RUST-OLEUM is the answer. For 25 years it has proved its capacity to stop and prevent rust at sea, in fume-choked industrial areas, on railroad rolling stock, bridges and signaling equipment.

RUST-OLEUM . . . an exclusive formula . . . protects metal with a tough, long-lasting pliable film that dries to a hard, firm finish that defies rain, snow, salt air, fumes and weathering. It adds years of extra use to metal roofs, tanks, sash, fences, stacks, gutters, downspouts, machinery and other metal surfaces.

RUST-OLEUM decorates as well as protects. It is available in all colors, aluminum and white. It can be applied to metal where rust has already started. You don't have to remove all the rust.

RUST-OLEUM is stocked and sold by Industrial Distributors in most principal cities. See our complete catalog in Sweets, or write for full information.

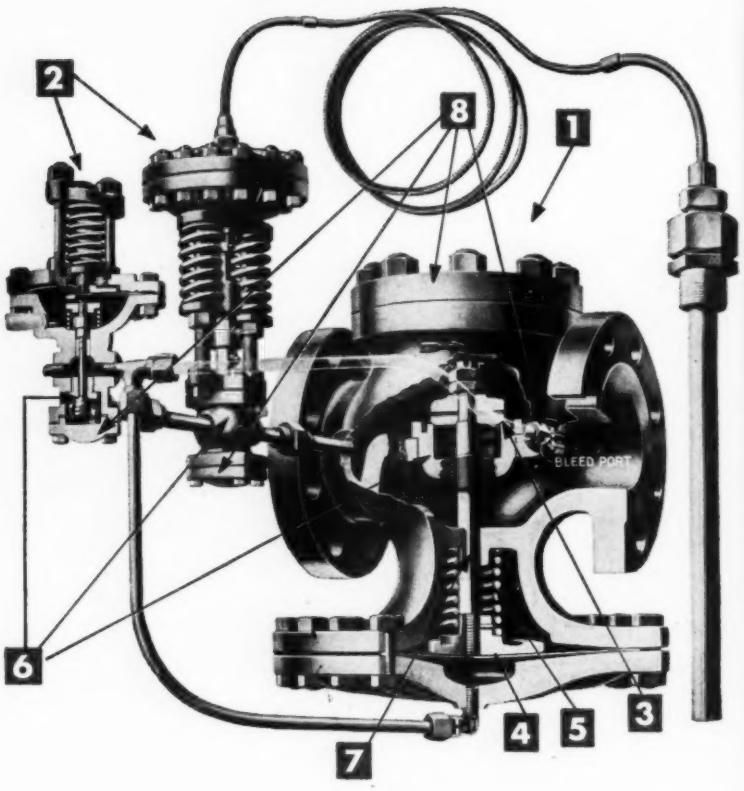
RUST-OLEUM CORPORATION

2455 Oakton Street, Evanston, Illinois

NOW! CUT COSTS OF PRESSURE A

These SPENCE features *show you how:*

YOU SAVE MONEY with Spence Self-Operated Regulators because they function dependably and accurately year after year *without requiring extensive repairs or special attention.* This long trouble-free life means less down-time of the system, less time and money wasted on replacement of parts. Thus, you lower over-all costs and, at the same time, are assured of quality performance.



The cutaway illustration above shows why Spence Regulators . . .

REGULATE ACCURATELY

1 The single-seated *packless* main valve is actuated by a large balanced diaphragm. The construction eliminates the need for closely fitted parts which may stick or bind due to uneven expansion or foreign matter.

2 One or more sensitive pressure or temperature pilots control the main valve.

Because the Spence design minimizes friction, accurate regulation remains unaffected by changes in service conditions or length of service.

STAY ON THE JOB FOR YEARS

3 SECO Metal Seats and Discs resist wiredrawing. More than 20 years of experience with SECO Metal in thousands of installations has failed to produce one single case where SECO Metal has been cut by steam.

4 Spence metal diaphragms, under usual conditions, never require replacement. Spence Regulators have few moving parts and those few are ruggedly constructed and seldom require attention.

5 The spring in the Spence Regulator is out of the path of the fluid flowing through the valve. It operates at low unit stress to assure performance over an unusually long life.

REDUCE MAINTENANCE

6 The seat and disc of the main valve and pilot can be cleaned and any working part removed, without taking the main valve out of the line.

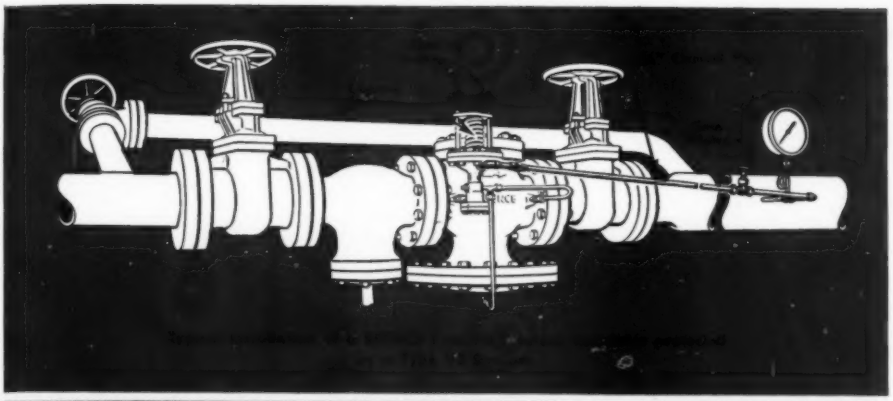
7 All main valves and most pilots are built without stuffing boxes. This packless construction eliminates much time-consuming maintenance.

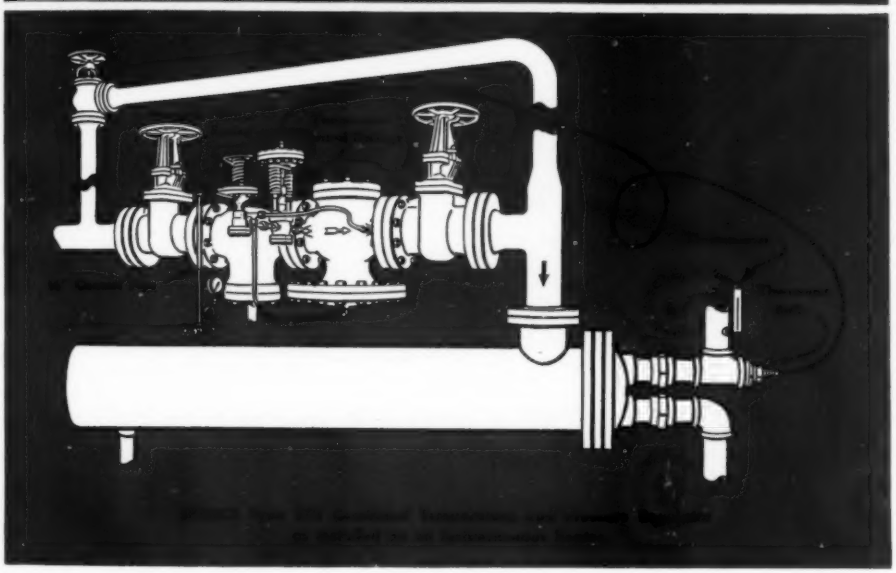
8 No dismantling is necessary to inspect the main valve disc, the pilot valve member and the SECO Metal bleedport. Special openings are provided. Inspection is easier, too, because the pilot is not an integral part of the main valve.

SPENCE ENGINEERING COMPANY, INC. V

RE AND TEMPERATURE CONTROL

TYPICAL INSTALLATIONS





HAVE UNUSUAL VERSATILITY

9 The Spence Regulator, due to its unique design, will serve many functions and will handle all the various types of fluids under a wide range of service conditions. One of the great advantages of this Spence design is the interchangeability of all pilots on all sizes of main valves. Any main valve can be changed from a pressure to a temperature regulator or vice versa *simply by substituting one type of pilot for another.*

Spence Regulators are built in sizes from 1/4" to 12" for service with air, steam, water, oil or gas. With minor adjustments, any Spence Regulator can be easily switched from one service to another.

FREE BULLETIN gives complete engineering details and selection data. It features a full color, fully illustrated description of the operating cycle of a Spence Regulator. Send for your copy of this valuable bulletin today.

9

TYPICAL PRESSURE PILOT MODIFICATIONS AVAILABLE		
Type	Delivery Pressure Range, PSI	Normal Accuracy + or —
D	3-150	1 PSI
DS	1-25	½ PSI
W	0-10	¼ PSI
W7	0-3	½ OZ

LIST OF USERS

Cleveland Cliffs Iron Company
Tennessee Coal, Iron & Railroad Corp.
Spring Cotton Mills
Ford Motor Company
Cochrane Corporation
Philadelphia Electric Co.
Pennsylvania Power and Light Corporation
L. H. Gilmer Company
York Corporation
Jones & Laughlin Steel Corporation
Duluth Steam Corporation
Rochester Gas & Electric Company
Consolidated Gas & Electric Company of Baltimore
Phenix Natural Gas Company
Cutter Laboratories

TYPICAL APPLICATIONS OF SPENCE REGULATING VALVES

Auxiliary Steam Control
Heating Systems
Live Steam Make-up
Steam Feed to Evaporators
Steam Feed to Vacuum Pans
Gas and Oil Fuel Control
Steam Jacketed Kettles
Drying Rolls and Cans
Steam Heated Presses
Back Pressure Control
Bleed Steam Control
Turbine By-pass Control
Milk Preheaters
Steam Atomizing Oil Burners
Steam Pump Governors
Hot Water Heaters
Fuel Oil Heaters
Altitude Control
Condenser, Cooling Water Control

Spence

C. WALDEN, NEW YORK

READERS' GUIDE

to equipment advertised and available literature

For your convenience all the literature offered in the advertising of this issue is briefly reviewed in this guide. If you are interested in a particular type of equipment, such as electrical for example, refer to the section "Electrical Equipment", read the advertisements, and select the literature you want. Circle the corresponding numbers on one of the postage-free cards on page 37 and mail. You will receive promptly the additional information you desire.

BOILER & FURNACE CONSTRUCTION UNITS

1—See page 120. Cost-Saving Steam Generators: Powermaster is a completely equipped steam plant, available in sizes from 15 hp up. You can burn light oil, heavy oil, gas or a combination of these three fuels. Wired, piped, insulated and tested at the factory. Get complete information by sending for the latest Powermaster catalog. Orr & Sembower, Inc.

2—See page 49. Packaged Steam Generators: Send for fully illustrated Catalog 202 that gives complete details and engineering data for units available in 17 sizes from 20 to 500 bhp to operate at pressures up to 250 psi 80% thermal efficiency guaranteed. Superior Combustion Industries, Inc.

3—See page 134. Firebox Type Boilers: Especially adapted for high pressure—10 to 304 hp, 100, 125, 150 lb wp. Send for full information and free 6 in. scale with pipe diameter markings. Kewanee Boiler Corp.

4—See page 67. Steam Generating Units: Complete line of bent tube steam generators, designed to burn solid, liquid, or gaseous fuels. Outstanding installations point to proved use-satisfaction. Write for complete data and information. Henry Vogt Machine Co.

5—See page 115. Steam Generator: Write for more data on the Union "H" Type steam generator—steel cased boiler with superheater, dust collector, air heater, ducts, fans, and stacks out-of-doors. Union Iron Works.

6—See page 175. Complete Steam Generators: A proposal covering your specific requirements will be submitted gladly upon request. Write direct or check with your nearest Springfield Boiler Co. representative. Springfield Boiler Co.

7—See page 129. Steam Generators: Wickes can fill your exact requirement for boilers of any type up to 250,000 lbs. steam per hour and 850 psi. Their knowledge of steam generation is available for your consultation, without obligation. Descriptive literature gladly sent upon request. The Wickes Boiler Co.

8—See page 131. Boiler Baffle Walls: Bulletin BW-44, 18 pages containing valuable useful data on modern Baffle Wall design and construction for all water tube boilers. The Engineer Company.

BOILER FEED WATER

9—See page 154. Water Conditioning Chemicals: Easy to control scale and corrosion in boilers, steam and condensate lines, water jackets, condensers. Send for bulletin giving full information on Wright Chemicals and their applications. Wright Chemical Corp.

10—See page 11. Water Treatment System: Write today for complete information on the Naico System of Water Treatment and how it can reduce your costs and increase effectiveness of water treatment in your plant. National Aluminate Corp.

11—See page 48. Chlorinators: Reduce down time, cut operating costs, improve heat transfer with the Visible Vacuum Chlorinator for the application of chlorine to cooling water circuits through the W & T De-sliming process. For complete information, write today. Wallace & Tiernan Products, Inc.

12—See page 62. Water Treatment Service: Write for New Bulletin: "Corrosion Protection of Steam Condensate Return Systems". Just off the press, this informative bulletin outlines the Bird-Archer method of amine treatment. Write for your free copy today. The Bird-Archer Company.

13—See page 29. Cold Water Softening: Write today for the full story of Rapid Reactors, Cochrane's versatile water clarification and softening equipment. Combines speed and efficiency with low original cost and minimum operating costs. Cochrane Corp.

CLEANERS AND BLOWERS

14—See page 169. Combination Blower-Suction Cleaner: It's a snap to rid all of your equipment of damaging dirt, dust, and grit with this portable cleaning tool. 5 models with attachments for every cleaning job. Write for more data. Clements Mfg. Co.

15—See page 51. Flux Recovery: For use with automatic welding heads, new vacuum machines salvage valuable flux, save man-hours, and eliminate disposal problems. Write for illustrated Flux Recovery Folder with complete data. Invincible Vacuum Cleaner Mfg. Co.

16—See page 164. Portable Electric Blower: Protect motors and other equipment from burnouts and bearing failure by removing dangerous dust, dirt and lint. Write for Bulletin 579 for complete information on the TORNADO. Breuer Electric Mfg. Co.

17—See page 135. Vacuum Cleaning Equipment: Portable cleaners or stationary cleaning systems provide an economical solution to the problem of removing troublesome dust accumulations in industrial plants. Send for literature. U. S. Hoffman Machinery Corp.

COMPRESSORS

18—See page 111. New Air Compressor Line: It's the Worthington Balanced Angle Air Compressor. Send for new bulletin that gives you complete details on the redesign of this compressor to make it as up-to-date inside as out. Pump and Compressor Merchandising Div., Worthington Pump and Machinery Corp.

DIESEL POWER

20—See page 45. Diesel Power Units for Industrial Applications: Completely equipped and ready to operate, these engines have valve-in-head design built-in all-weather starting system, full-pressure lubrication, variable speed governor and other features. Complete information on request. Industrial Power Div., International Harvester Co.

21—See page 64. Diesel Engines: If you're looking for reliability and long life in your diesel engines, then you should have complete information on Cooper-Bessemer—dragline, marine, stationary, locomotive, or any other heavy-duty power application. Mail your inquiry today for full facts. The Cooper-Bessemer Corporation.

22—See page 119. Muffler System: Fluor Series "D" Muffler System gives the highest muffling efficiency obtainable. Needs no redesign or alteration of existing plans for installation in new or old plants. Requires no more space than conventional mufflers. Submit your plans for recommendation and quotation today. No obligation. The Fluor Corp., Ltd.

23—See page 123. Dual-Fuel Engines: Push-button control permits the switch from oil to gas or gas to oil instantly. Supercharged and non-supercharged models range from 170 to 1500 hp. Fully illustrated booklet on request. Superior Engine Division. National Supply Co.

DUST & FLY ASH COLLECTING EQUIPMENT

24—See page 59. Aerotec Dust Collector: Efficiency at full load is 98%. Even when load is reduced to 0.5 w.g., equivalent to half load, efficiency is 91.5%. If you're looking for compactness plus efficiency, get full details from Thermix first. The Thermix Corporation. The Aerotec Corporation.

25—See page 70. Fly Ash Arrestor: Send for your free copy of Bulletin 6a/8. Contains complete description and specifications for high efficiency multiple tube fly ash arrestors, low draft loss chimney type fly ash arrestors, fly ash reinjection systems, induced draft fans, constant ratio dampers, and special duct work. Also available upon request a detailed pamphlet covering the Vulcan Smoke Eliminator. The Fly Ash Arrestor Corp.

26—See page 122. Dustube Dust Collectors: Write for your copy of Catalog 72-A. It explains in detail these outstanding advantages of Dustubes: clothtube type filters, ease of inspection, quick filter replacement, lower power costs, high efficiency, better dust removal. American Wheelabrator & Equipment Corp.

ELECTRICAL EQUIPMENT

27—See page 160. Renewable Fuse: Send for free Booklet 206-A that shows you the many advantages possible with the Powder-Packed custom-built element in Trico Fuse. Also request Bulletin No. 7 for more details on "Kliplok" Test Clamps for heavy duty temporary connections, meter and motor testing, jumpers, welding, etc. Trico Fuse Mfg. Co.

28—See page 34. Wireways: Factual and interesting booklet, "A Wirewa You'll Like," illustrates all fittings and contains installation data. Write for your copy. National Electric Products Corp.

29—See page 25. Co-ordinated Motor Control Service: Allis-Chalmers Control Specialists can make sure that important starter details like type, size, enclosure, and protective devices are the best for your motor application. Check with your nearby A-C Authorized Dealer or Sales Office today. Allis-Chalmers Mfg. Co.

30—See pages 40, 41. Fusetrons: A fuse to which is added a thermal cutout offers large time-lag and less electrical resistance. Fits standard fuse blocks and may be used throughout entire electric system. Send for complete facts. Bussmann Mfg. Co.

31—See page 53. Electric Motors: Built in a wide variety of types and sizes from fractional to 400 hp. Models for practically every kind of service. Write for complete data. Century Electric Co.

32—See page 161. Electrical Power Equipment: All inclusive service of engineering rebuilding, and sales distribution of electrical power equipment. Complete stock of guaranteed rebuilt equipment. Send your power problem to Chicago Electric Company.

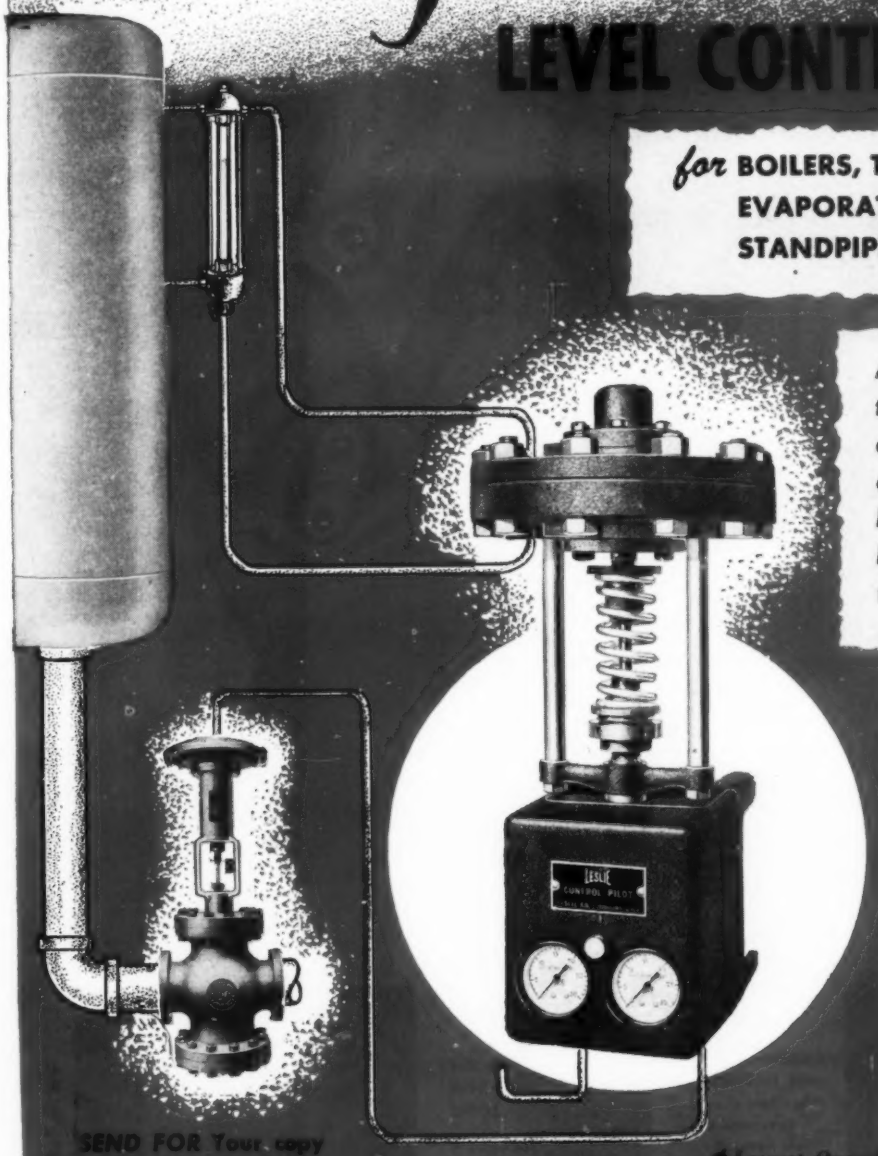
(Continued on page 24)

LESLIE TRADE MARK

Floatless LEVEL CONTROL

for **BOILERS, TANKS, EVAPORATORS, HEATERS, STANDPIPES, etc.**

A rugged, accurate control designed to overcome the limitations of floats, stuffing boxes, float cages, bellows, linkages, torque tubes, etc.



A simple solution to a troublesome problem

SEND FOR Your copy of new LESLIE Floatless Level Control Leaflet

Lowest Overall Cost per Operating Year

Look for LESLIE REGULATORS under "Valves" or "Regulators" in your classified telephone directory in the following cities where LESLIE factory-trained engineers are located.

Albany, N. Y.
Atlanta, Ga.
Baltimore, Md.
Beaumont, Tex.
Birmingham, Ala.
Boston, Mass.
Bridgeport, Conn.
Buffalo, N. Y.
Chicago, Ill.
Cincinnati, Ohio
Cleveland, Ohio
Denver, Colo.
Detroit, Mich.
Galveston, Tex.
Greensboro, N. C.
Greenville, S. C.
Honolulu, Hawaii
Houston, Texas
Indianapolis, Ind.
Kansas City, Mo.
Kingsport, Tenn.
Los Angeles, Calif.
Louisville, Ky.
Memphis, Tenn.
Milwaukee, Wis.
Minneapolis, Minn.
Mobile, Ala.
Monroe, La.
Montreal, Canada
New Orleans, La.
New York, N. Y.
Orlando, Fla.
Philadelphia, Pa.
Pittsburgh, Pa.
Ponca City, Okla.
Portland, Ore.
Providence, R. I.
Richmond, Va.
Rochester, N. Y.
Rutherford, N. J.
Salt Lake City, Utah
San Francisco, Calif.
Savannah, Ga.
Seattle, Wash.
Spokane, Wash.
St. Louis, Mo.
Syracuse, N. Y.
Toronto, Canada
Vancouver, Canada
Wilkes-Barre, Pa.
Wilmington, Calif.
Youngstown, Ohio

ESTABLISHED 1900
LESLIE CO.

263 Grant Avenue, Lyndhurst, New Jersey

PRESSURE REDUCING VALVES • PUMP GOVERNORS • PRESSURE CONTROLLERS
TEMPERATURE REGULATORS • SELF CLEANING STRAINERS • LESLIE-TYFON WHISTLES

Edward Presents

Here's a brand-new all-purpose valve series with unusually wide applicability—ideal for almost any service where small O. S. & Y. steel valves are used. Drop forged steel for greatest strength in high pressure or temperature service . . . the simplest packing arrangement imaginable . . . tight, easily accessible union or bolted bonnet joints . . . bronze yoke bushings to prevent stem galling or freezing . . . Microscopically mated seats and disks . . . lock welded parts to prevent loosening in service . . . EValpak heat-resistant molded premium type packing . . . interchangeability of parts for reduced maintenance inventories . . .

These and dozens of other features are standard in the new Edward Fig. 444 series, now available for stock shipments in most sizes, ¼ in. to 2 in. inclusive, either 600 or 1500 lb sp.

SIMPLICITY OF PACKING

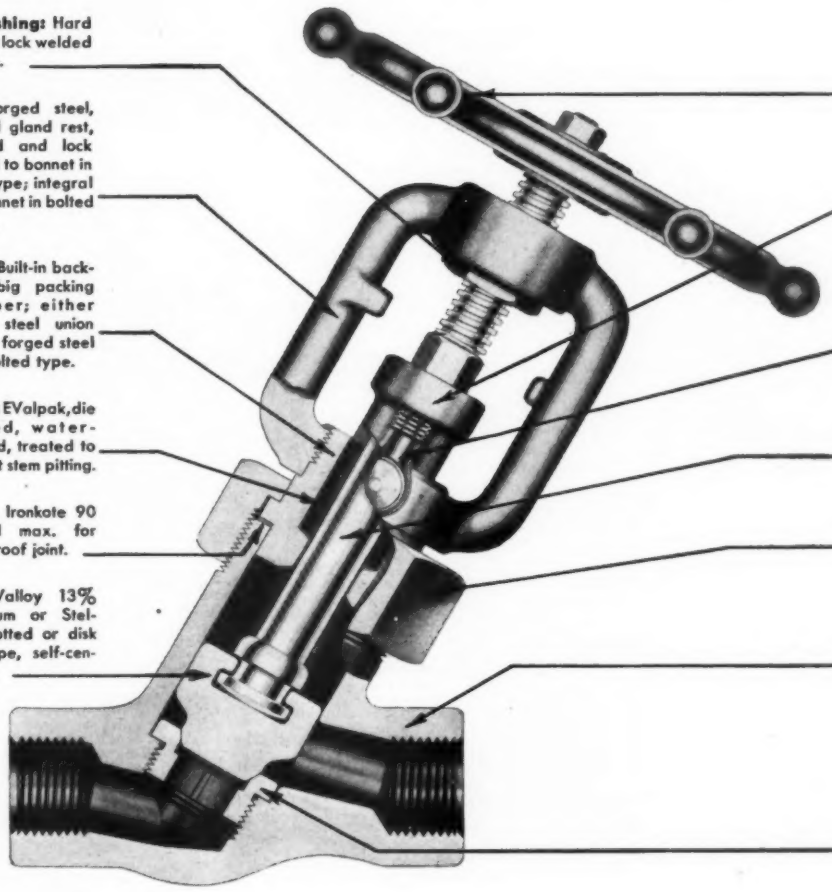
See how easy it is to repack the new Edward Fig. 444 series. Gland is held on special rests on yoke. Gland bolts swivel out of way, can't come off. Both hands are free to insert packing in generous space between stem and yoke. Pressure-tight backseating for repacking under pressure.

TIGHTEST SEAT-DISK JOINT

No valve is better than its seat-disk joint. All Edward Fig. 444 seats and disks are precision borized to identical angles in mated pairs, then tested on Edward built Micron-o-scope, measuring to .00025 of an inch, for absolute tightness and concentricity.

The All-Purpose Steel Valve!

NEW FIG. 444 SERIES!



Yoke Bushing: Hard bronze, lock welded to yoke.

Yoke: Forged steel, integral gland rest, screwed and lock welded to bonnet in union type; integral with bonnet in bolted design.

Bonnet: Built-in backseat, big packing chamber; either rolled steel union ring or forged steel stud bolted type.

Packing: EValpak, die formed, waterproofed, treated to prevent stem pitting.

Gasket: Ironkote 90 Brinnell max. for leak-proof joint.

Disk: EValloy 13% chromium or Stellite, slotted or disk nut type, self-centering.

Handwheel: Malleable iron, knobbed for easy gripping.

Gland: Forged steel, through bolted, accurately fitted to stuffing box.

Swing Gland Bolts: Forged steel, EValized for longer, corrosion-free life; swivel out of way but can't come off.

Stem: Hardened, centerless ground EValloy, with backseating shoulder (on disk nut on larger sizes).

Union Ring: Rolled or forged steel, hexagonal.

Body: Heat treated forged steel, inclined stem globe type for lowest pressure loss, screwed or socket welding ends.

Seat: EValloy 13% chromium or Stellite on stainless steel; borized in mated pair with disk.

EDWARD VALVES, INC.,
40 West 144th St., East Chicago, Indiana

Please send a copy of Bulletin 501 describing your new Fig. 444 all-purpose forged steel valves.

Name _____

Company _____

Address _____

City _____ Zone ____ State _____

NOW READY! New Bulletin 501 gives you dimensions, ratings, full data on the new Edward Fig. 444 series. Send coupon now for your copy.

Edward Fig. 444 series are built in sizes ¼ to 2 in. inclusive, globe or angle, screwed or socket welding ends, 600 or 1500 lb sp classes, in carbon or chromium molybdenum steel.

Another Product

Edward Valves, Inc.

Subsidiary of ROCKWELL MANUFACTURING COMPANY

EAST CHICAGO, INDIANA

READERS' GUIDE ... CONTINUED ...

(Continued from page 20)

33—See page 139. Time-Delay Fuses: New Economy Catalog gives full data on renewable cartridge fuses for protection where time delay is most needed—135 to 200% overloads. Economy Fuse and Mfg. Co.

34—See pages 26, 27. I-T-E Switchgear: If you have any questions on modern HV switchgear construction, send for Bulletin 7000-A on I-T-E's newest 5KV Switchgear. Also request Bulletin 6003-D a complete reference guide to I-T-E 600V Switchgear assemblies. I-T-E Circuit Breaker Co.

FLOOR REPAIRS

35—See page 162. Instant-Use Floor Patch: Tough, plastic material which restores broken concrete to solid smoothness. Run traffic over it immediately. Write for details of free trial offer and complete information. Flexrock Co.

FUELS AND FIRING EQUIPMENT

36—See page 148. Stoker-Veyor: Ask for Bulletin 916. Completely describes Stoker-Veyor—speeds filling of hopper and removal of ashes. American Conveyor Co.

37—See page 121. Industrial Coal: Graham, Browder, and Powerhouse—these three trade-marked coals are dependable guides to high efficiency and low cost. Test the one recommended for your plant by Southern Coal Company's engineers. Write for profitable engineering counsel today. Southern Coal Company, Inc.

38—See page 165. Fuel Oil Additive: Houghto-Solv is Houghton's proven additive for treatment of fuel oil systems to remove sludge by taking it into solution and actually making it burnable. Costs only a tiny fraction of a cent per gallon of fuel oil. Write for complete, valuable data. E. F. Houghton & Co.

39—See page 141. New Automatic Oil Burner: Wide-range oil-burning system assembled complete on one base for all types of boilers and furnaces from 100 developed hp and up. Write for your copy of Bulletin 400 for details and specifications. Peabody Engineering Corp.

HEATING, VENTILATING AND AIR CONDITIONING

40—See page 7. Air Handling and Conditioning Equipment: Heavy construction gives extra years of service to Clarage units. You can rely on Clarage equipment for low operating and upkeep costs. Contact Clarage first on your next project in their field. Clarage Fan Company.

41—See page 127. "Blue Ribbon" Ventilators: Use coupon in this advertisement to get complete information for your specific ventilating problem. No cost or obligation. Coppus Engineering Corp.

42—See page 172. FAR-AIR Filters: Advantages include: stronger frames, handles 50% more air per unit, easier to clean, holds more dirt, less pressure loss. Available in a wide range of types and sizes for dirt, lint, grease, entrained water, ink, paint and most other filtering applications. Write for complete information. Farr Co.

43—See page 69. Electric Heating: Write for the booklet, "100 Ways to Apply Electric Heat", and Chromalox Catalog 42. Edwin L. Wiegand Co.

44—See page 146. Automatic Gas Fired Unit Heaters: Write for catalog that describes special features such as fan circulation for hot days and gas heat any day, special heat exchanger, extra large fan, economical operation. Write today. Reznor Manufacturing Co.

45—See page 136. Ventilation Heaters: Write for the new edition of Trane Bulletin DS-364 for details on Trane Ventilation Heaters. They deliver enough outside air at building temperature to prevent untempered outside air entering because of inside negative pressure. Ideal for summer ventilation. The Trane Company.

46—See page 150. Air Conditioning: Niagara "Controlled Humidity Method" gives complete control of temperature and relative humidity. Provides dry air at normal atmospheric temperatures with little or no refrigeration. Read this informative advertisement then write for additional data. Niagara Blower Co.

INSTRUMENTS

47—See page 145. Water Level Gauges: These EYE-HYE units solve your remote reading problems for boilers, heaters, surge tanks or other vessels. Write today for complete information. The Reliance Gauge Column Co.

48—See page 147. Trulevel Gages: This design brings the water level gage down where you can see it for greatest accuracy and safety. Write for Trulevel Data Unit No. 38. Jerguson Gage & Valve Co.

49—See page 170. Automatic Liquid Measuring Gages: Write for complete details on liquid level gages for measuring liquids of all kinds. Dial readings in feet, inches, gallon, pounds or any desired units. The Liquidometer Corp.

50—See page 47. All-Metal Thermometers: Easy readability, combined with rugged, all-metal construction, assures long-time dependability. Thermometers for most industrial applications — wide variety of types. Write for Thermometer Catalog today. Weston Electrical Instrument Corp.

51—See page 164. Shuntflo Meters for Steam, Air, or Gas: High accuracy over wide range is another important feature of Builders Shuntflo Meter. For engineering information and Bulletins 400-F1 and 400-F2, write today. Builders-Providence, Inc.

52—See page 155. Ellison Gages: Check the bulletins you want and write for them today: Bull. 22 for straight line pointer draft gages; Bull. 9-F describes inclined draft gages; Bull. 20-F gives data on gas analyzers. Ellison Draft Gage Co.

53—See page 157. Liquid-in Glass Instruments: Send for literature on Princo Thermometers, Hydrometers, Absolute Pressure Gauges, Thermostats and Thermoregulators, Barometers, Hygrometers, or Psychrometers. For information on complete line, ask for a copy of "The Princo Line". Precision Thermometer & Instrument Co.

54—See page 149. Combustion Control: Publication 47-605 is exceedingly helpful in improving steam plant efficiency and reducing fuel costs. It contains many descriptions of how other plants are solving their combustion control problems. The Hays Corporation.

55—See page 159. Low Water Signals: For the protection of small boilers these units are simple to install and effective in operation. Bulletin 570-B gives complete data. Wright-Austin Co.

56—See page 30. Flow Meters: Write for Publication 47-800 for full details on Hays-Penn Flow Meters, for every metering need. The Hays Corporation.

INSULATION

57—See page 63. Powerhouse Cement: The new finishing cement that insulates. Only one coat needed. Adheres to blocks, blankets and cements. Gives Smooth, hard surface. Easy on labor and budget. Write for full information and free sample. Baldwin-Hill Company.

LUBRICANTS AND FILTERS: PURIFIERS AND LUBRICATORS

58—See page 169. Centralized Lubrication: Ask for free Catalog No. 25 and Case Studies showing how to save oiling labor, bearing expense, production time and lubricant. The Farval Corporation.

59—See page 15. Colloidal Graphite: Send for your copy of the New Acheson Bulletin No. 424 on the subject *"dag"* colloidal graphite for industrial lubrication. See how it will pay you to incorporate *"dag"* colloidal graphite into your present lubricants. Acheson Colloids Corp.

MAINTENANCE

60—See page 171. Complete Service for Elevated Water Tanks: 30 years' experience means safety, service, and satisfaction on every water tank reconditioned by Dixie Tank and Bridge Co. Write for your free copy of publication, "Sound Principles of Water Tank Maintenance and Tank Talk." Dixie Tank and Bridge Co.

61—See page 17. Rust Preventive: Rust-Oleum seals metal so that no rust-causing oxygen can reach it. Available in a full range of colors. Write for complete catalog. Rust-Oleum Corp.

62—See page 170. Free Repair Handbook: Filled with time-saving, money-saving uses for Smooth-On in plants and shops. Clear, practical directions. 170 diagrams. Send today for your copy. Smooth-On Mfg. Co.

63—See page 173. Santobrite Algaecide: Maintains cooling tower efficiency by preventing sluggishness and obstructions in the circulating system. No special equipment is required. Send for Bulletin 0-15. Organic Chemical Div., Monsanto Chemical Co.

64—See page 165. Pipe Joint Sealing Compounds: Pipe joints and fittings sealed with Key sealing compounds do not leak. Connections will not freeze and reopening is easy. Send for free sample. Key Company.

MATERIAL HANDLING

65—See page 153. Pneumatic Ash Handling System: Economical, labor-saving "Vac-Veyor" conveys and delivers the ashes to the silo in a completely dry condition. Write for more information. Beaumont Birch Co.

66—See page 126. Fork Trucks and Towing Tractors: There's economy of operation in the planned application of Clark's Modern Methods. Consult Clark for an unbiased recommendation. Your inquiry incurs no obligation. Clark Equipment Company, Industrial Truck Division.

67—See page 167. Car Pullers, Barge Movers: Electric, gasoline, diesel. Write for full information on power-driven capstans, gypsies, and single and double winches for all materials-handling applications. Silent Hoist & Crane Co.

68—See page 143. Pneumatic Conveyors: Write today for full details proving pneumatic conveyors can reduce your handling costs. You have less labor cost, no material waste, and better working conditions. Dracco Corp.

69—See page 31. Industrial Lift Trucks: This company maintains industrial truck service over the entire world for its pneumatic tired units with capacities ranging from 2,000 to 30,000 pounds. Hyster Company.

70—See page 39. Bulk Materials Handling Systems: Long experience has given Stephens-Adamson Engineers the "know-how" that cracks bulk materials handling problems quickly and economically. Their staff is at your service. Write them today. Stephens-Adamson Mfg. Co.

71—See page 4. Belt Conveyor Idlers: Self-aligning idlers for regular or reversing travel and roller bearing idlers are described in Book No. 1915. Write for it. Link-Belt Co.

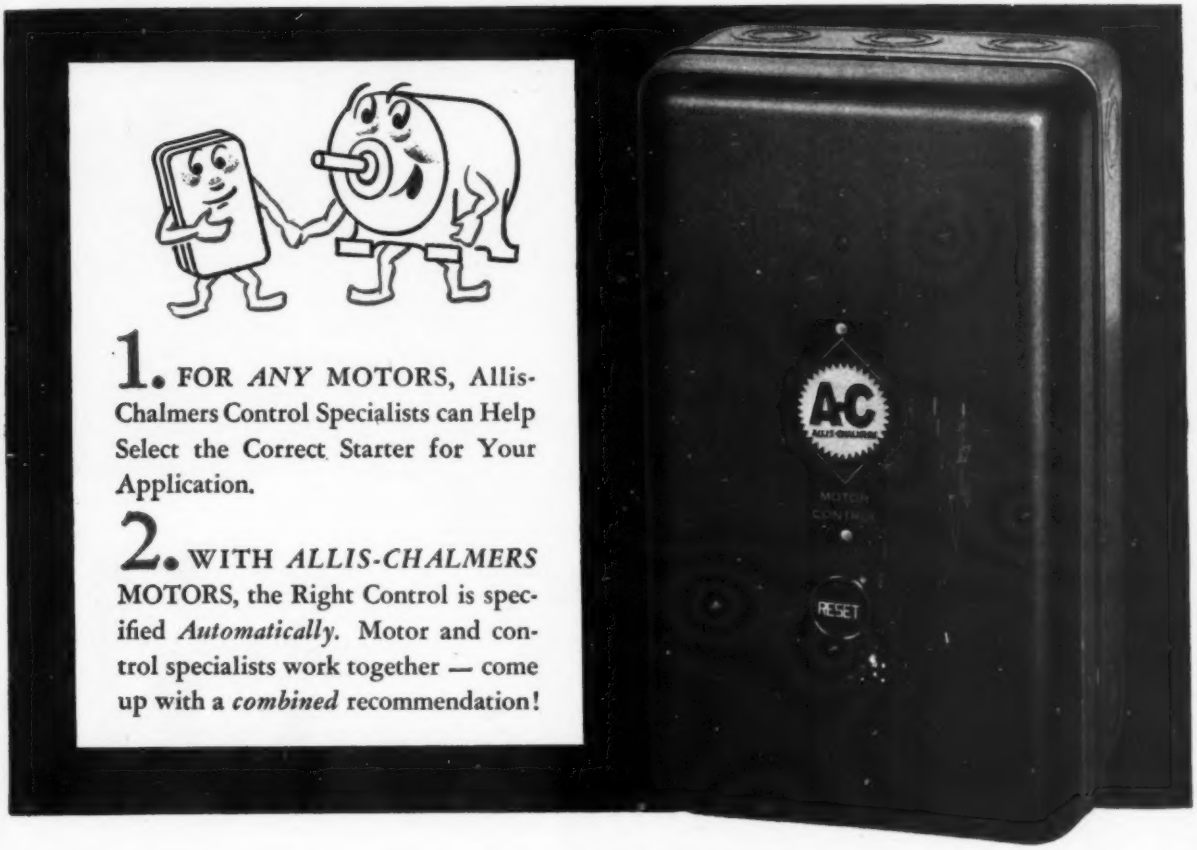
72—See page 52. Material Handling: If you're looking for cost-reducing equipment for material handling and processing in your plant, let the vast experience of this company work for you. Drop them an inquiry today for complete information. The Jeffrey Mfg. Co.

73—See page 151. Conveyor Systems: Complex conveyor problems reduced to an efficient, simple series of operations by thorough engineering. Write for solution of your conveyor problems. Hewitt-Robins, Inc.

74—See page 158. Bulk Material Handling: Write for free literature on these Syntron products to speed up your bulk material

(Continued on page 28)

Get this COORDINATED Motor-Control Service!



1. FOR *ANY* MOTORS, Allis-Chalmers Control Specialists can Help Select the Correct Starter for Your Application.

2. WITH *ALLIS-CHALMERS* MOTORS, the Right Control is specified *Automatically.* Motor and control specialists work together — come up with a *combined* recommendation!

RESULT: YOU'RE DOUBLY SURE that important starter details like type, size, enclosure, and protective devices are the *best* for your motor application!

Whether you're in the market now for motors and starters, or starters alone... check the *complete* Allis-Chalmers line.

HERE ARE FEATURES YOU'LL GET IN SIZE O-3 MAGNETIC STARTERS:

- Roomy enclosures and clearly marked terminals are easy to wire.
- Shading coils eliminate alternating current hum.
- Enclosed chambers confine arcing.
- Double-break silver to silver contacts and other replaceable parts are easily accessible.

For *any* motor . . . Squirrel-Cage, Wound Rotor or Synchronous . . . Allis-Chalmers offers controls coordinated to your needs. For manual or magnetic across-the-line starters, standard or special purpose starters... resistor, reactor, or auto-transformer reduced voltage starters . . . call your nearby A-C Authorized Dealer or Sales Office today.

A-2903

ALLIS-CHALMERS 948A SO. 70 ST.
MILWAUKEE, WIS.

Texrope is an Allis-Chalmers trademark.

Sold . . .
Applied . . .
Serviced . . .

by Allis-Chalmers Authorized Dealers, Certified Service Shops and Sales Offices throughout the country.

MOTORS — ½ to 25,000 hp and up. All types.

TEXROPE — Belts in all sizes and sections, standard and Vari-Pitch sheaves, speed changers.

PUMPS — Integral motor and coupled types. Sizes and ratings to 2500 GPM.

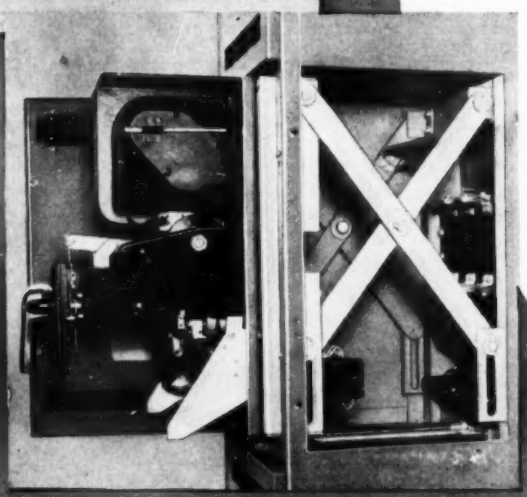
ALLIS-CHALMERS

"You can control any motor with an Allis-Chalmers motor starter."

Here's the *best* wo

I-T-E MULTUMITE SWITCHGEAR FEATURES EASIER ACCESS TO BREAKERS!

On both high- and low-voltage Multumite Switchboards, the easy-to-remove breakers are praised by maintenance men. I-T-E 5KV Breakers are truck-mounted for quick, easy withdrawal from compartments. Low-voltage I-T-E Breakers are pantograph-mounted, and all components are accessible when breaker is withdrawn. In the fully withdrawn position, breaker can easily be removed; the metal feet on its base make it self-standing unit. Both HV and LV breakers may be tested while still in their compartments.



Send for these descriptive bulletins

BULLETIN 6003-D: A complete reference guide to I-T-E 600V Switchgear assemblies. Contains detailed information on I-T-E Multumite and helpful facts for specifying and ordering complete switchgear installations.

BULLETIN 7000-A: Describes I-T-E's newest 5KV Switchgear — illustrated and supplemented with practical, easy-to-read drawings and diagrams. If you have any questions on modern HV switchgear construction, it will pay you to have this bulletin.

Get both of these helpful bulletins now. Ask your local I-T-E Representative or write I-T-E General Offices.

way to order electrical protection

Let I-T-E supply the complete job!

You'll discover how easy—and economical—solving electrical distribution problems actually is when you put the I-T-E organization to work for you. I-T-E furnishes everything you need in engineering and equipment. For instance, here's what you get when I-T-E supplies your switchgear:

• PROPER APPLICATION FOR YOUR SPECIFIC NEEDS: Every I-T-E Sales Engineer is a *switchgear specialist*—fully qualified to assist you in planning all parts of your distribution system. Thus, your I-T-E Switchgear is designed for your specific problems—built to meet your needs!

• EFFECTIVE, PROPERLY COORDINATED UNITS: I-T-E supplies the finest components for every part of your distribution system. I-T-E's own equipment is designed better to last longer. Purchased auxiliaries must meet highest standards of excellence. And all components are coordinated by I-T-E's engineers into efficient, functional units of maximum dependability.

• QUICK, EASY INSTALLATION: Your I-T-E equipment is completely assembled and tested by I-T-E *before* shipment. It is delivered to you, ready for connections. Installation is simplified; chances of failure because of improper assembly are minimized.

• A SYSTEM THAT'S EASY TO OPERATE, EASY TO MAINTAIN: All components of I-T-E units are functionally arranged for easy, simple operation. And your maintenance men will be enthusiastic when they see how much more *accessible* I-T-E units are. Inspections and maintenance are easier, take less time!

• IT'S EASY TO ORDER, WITH QUALITY GUARANTEED! A *single* order is all it takes for a *complete* I-T-E job—from the simplest panelboard, to everything necessary for a complete distribution system. I-T-E designs, builds, and ships your job as a "package"—and accepts complete responsibility for the operation and performance of every component!

Extra service and extra quality—which you get without extra cost—make I-T-E your best switchgear buy!

I-T-E

For *more dependable* Switchgear

specify I-T-E!

I-T-E Circuit Breaker Company
19th & Hamilton Streets, Philadelphia 30, Pa.

Power Switching Equipment Division: Railway & Industrial Engineering Co., Greensburg, Pa.
Canadian Mfg. & Sales: Eastern Power Devices, Ltd., Toronto
Export Sales: Philips Export Corp., New York

SWITCHGEAR • UNIT SUBSTATIONS • ISOLATED PHASE BUS STRUCTURES
CIRCUIT BREAKERS • MECHANICAL RECTIFIERS • RESISTORS
SPECIAL PRODUCTS

READERS' GUIDE ... CONTINUED ...

(Continued from page 24)

handling at reduced costs: Bin Vibrators, Vibratory Feeders, Small Parts Feeders, Selenium Rectifiers. Syntron Co.

75—See page 174. "Coal Handling Equipment": If you plan to modernize your present coal storage and handling equipment or to install a new system, you'll find this G-W Bulletin No. 300 extremely helpful . . . and most profitable. Write today for your free copy. Gifford-Wood Co.

PACKINGS AND GASKETS

76—See page 130. Dura Seal: For melting and sealing requirements of volatile, corrosive or abrasive fluids Write today for your copy of File No. DSIP covering Dura Seal applications. Durametallic Corporation.

77—See page 154. Flange and Joint Sheet Packing: Write for Bulletin SP-19 — the single sheet with eight perfect answers to all sheet packing and gasket requirements. Greene, Tweed & Co.

PIPE AND FITTINGS

78—See page 118. Flexible Metallic Hose: Seamless or interlocking, for every known application. Also hose built to your specifications. Write for latest development bulletins. Atlantic Metal Hose Co.

79—See page 166. "K" Fittings: Close-grained, tough, smooth, symmetrical. Approved by Underwriters' Laboratories. *Selected* by users where requirements are severe and exacting. Write today for new catalog containing complete data. The Kuhns Brothers Co.

80—See page 124. High Temperature Joints: Write for illustrated bulletin ands see for yourself how these new Chicksan Joints can help you cut leakage losses, operating and maintenance costs, and shut-down time now required for frequent repairs and replacements. Chicksan Company.

81—See page 161. Packaged Pipe Systems: Free booklet supplies complete information about Speed-Lay pipe systems for fast-laying, temporary and semi-permanent lines for water compressed air and other services. Albert Pipe Supply Co., Inc.

82—See page 162. Pipe Markers: Quik-Label pipe markers conform to American Standards Association Pipe Identification System. Stick without moistening. Can be read up to 75 feet. Specials made to your order. Send for useful literature and FREE SAMPLE today. W. H. Brady Co.

83—See page 158. Flexible Couplings: Get your copy of this complete catalog and Quick-Finding Selector charts to tell you exactly what coupling is right for any service from 1/6 to 2500 h.p. Lovejoy Flexible Coupling Co.

PLANT EQUIPMENT

84—See page 132. Steel Grating: Bulletin KD-1140 fully describes the Dravo line of Tri-lok grating, safety treads, open steel flooring, concrete armoring and other products. Send for your free copy. Dravo Corp.

85—See page 162. Ready-Made Steel Work Benches: Steel or laminated wood tops. Four standard heights, three widths, seven lengths. Send for your copy of "Hallowell" catalog for money-saving ideas. Standard Pressed Steel Co.

86—See page 160. Metal Cutting Band Saws: Write for complete details on the New Wells Model 49A. Fits the smallest shop's budget, yet does a man-sized job. Capacity: Rectangular—3½" x 6⅝"; Rounds—3½" diameter. Wells Manufacturing Corp.

87—See page 168. Electroforged Steel Grating: Provides safe footing with maximum open area for admission of light and air. Send for Bulletin 2296. Blaw-Knox Div. of Blaw-Knox Co.

POWER TRANSMISSION

88—See page 134. Flexible Couplings: New engineering catalog gives full information on these all metal couplings designed to eliminate backlash, friction, wear and cross-pull. Thomas Flexible Coupling Co.

89—See page 146. Plate Fasteners for Conveyor Belts: Write for Catalog Sheet describing their special design that spreads tension evenly and makes joints dust- and water-tight. Sizes for belts ¼" to 1½" thick. Armstrong Bray & Co.

90—See page 55. New Idea in V-Belt Sheaves: Look to the Dodge Taper-Lock. Proved in over ¾ million installations. Saves you time and money. Check with your local Transmissioneer or write today. Dodge Mfg. Corp.

91—See page 61. Roller Chain Drives: Write for Big Drive Catalog 649. Contains more information on Diamond Roller Chains. Non-slipping positive drives mean maximum output. Long-life dependability. Assistance or suggestions on appropriate drives are yours for the asking. Diamond Chain Company, Inc.

92—See page 168. Fan-Cooled, Worm Gear Speed Reducers: Write for Catalog 200 for standard drives, and Catalog 300 on Speedaires that do more work, deliver double the horsepower of standard worm units of same frame size. Save money, space, and weight. The Cleveland Worm & Gear Co.

93—See page 43. Roller Chains: For all the facts on roller chains and how they can help you, write for Bulletin 48-1. Baldwin-Duckworth Division of Chain Belt Company.

94—See page 50. V-Belts: The complete Vulco-Rope line, with the money-saving "concave side", includes a variety of types designed to fit specific requirements. Write for further information. The Gates Rubber Company.

95—See page 163. Belt Fasteners and Rip Plates: Bulletin F-100 furnishes data on fasteners for joining conveyor or elevator belts of all thicknesses. Also describes Flexco HD rip plates. Flexible Steel Lacing Co.

96—See page 136. Motor Couplings: Ask for Catalog 57 which gives full details, ratings, and service factors for gear-type, all-steel couplings. John Waldron Corp.

PUMPS

97—See page 116. Weinman Pumps: Designed and manufactured by Centrifugal Specialists who are concerned with but one product . . . pumps that work at maximum efficiency on every job. If your plant handles liquids in any form, it will pay you to talk with Weinman. An inquiry will get prompt attention. The Weinman Pump Mfg. Co.

98—See page 157. Well Water Systems: Yours for the asking—catalogs and bulletins fully describing Layne Well Water Systems. The unfailing service and many advantages of this completely dependable system make the purchase price even more reasonable. Layne & Bowler, Inc.

99—See page 138. Centrifugal Pumps: An inquiry will bring you the dependable recommendation of this company for the pump that's right for your liquid handling problem. The Deming Co.

100—See page 170. Free Bulletin: For complete information about Viking Pumps, write for Bulletin 50SG. You'll find the style and size you need, correctly engineered to do your job. Viking Pump Company.

101—See page 58. Warren Pumps: Radial and axial balance give increased dependability, efficiency and longer life. Wherever wear is inevitable after long service, renewable parts are provided and all parts are easily accessible. Write for Bulletin No. 241 and get the full story without cost or obligation. Warren Steam Pump Co., Inc.

102—See page 142. Metering and Proportioning Pump: New "K" Type Pump offers complete dependability and freedom from maintenance plus a whole new conception of metering and proportioning. Capacities to 300 gph per feed and pressure ratings up to 25,000 psi. Write for full details. Hills-McCanna Co.

REFRACTORIES

103—See page 169. Refractory Cement: Hot or cold, thick or thin patches made with Super No. 3000 are not affected by temperatures up to 3100° F. and being exceptionally adhesive, they hold on with a bulldog grip. Send for prices and further data today. Refractory & Insulation Corp.

REGULATORS AND CONTROLS

104—See page 109. Combustion Safeguard: Fireye is the safe, modern electronic combustion safeguard for oil, gas, and pulverized coal burners. Provides continuous monitoring of oil or gas flame, programming control for automatic ignition systems, boiler water level control and low level safeguard. Write for Bulletin 604-C for complete details. Combustion Control Corp.

105—See page 161. Room Thermostats: Hermetically sealed mercury switch and lustrous natural metallic finish are only two features of these distinctive room temperature controls. Write for Sensatherm Catalog. The Mercoid Corp.

106—See page 113. Water Blenders: Bulletin No. 800 shows how these units can be used to provide temperate water for washrooms or industrial purposes, and as recirculating cooling controls. Sarco Company, Inc.

107—See page 130. Dependable Flow Control: Write for Bulletin No. 101B for detailed information on the Davis line of float valves, float boxes, and fluid control valves. Davis Regulator Company.

108—See page 167. Temperature Indicating and Recording Regulators: Their accurate control helps to improve quality of products—speed up production and save steam wasted by overheating. Write for Bulletin 370 which shows the variety of models available. The Powers Regulator Co.

109—See page 160. Multiport Valves: Use electrically operated H&T Poppet type multi-port valves to make your Zeolite Water Softeners or Sand Filters automatic. You get top performance at lower cost. Write for more details. Hungerford & Terry, Inc.

110—See page 21. Floatless Level Control: Send for your copy of the new leaflet that presents this new floatless level control for boilers, tanks, evaporators, heaters, standpipes, etc. Leslie Co.

111—See pages 18, 19. Pressure and Temperature Control: Free Bulletin gives complete engineering details and selection data. It features a full color, fully illustrated description of the operating cycle of a Spence Regulator. Send for your copy of this valuable bulletin today. Spence Engineering Co., Inc.

STEAM TURBINES AND ENGINES

112—See page 60. Terry Turbines: Any Terry district representative will gladly give you full information on a turbine to meet your requirements, no matter how special they may be. Or write directly. No obligation. The Terry Steam Turbine Co.

113—See page 132. Steam Engines: Data book describes operating features of Troy-Engberg steam engines for driving power plant and processing equipment. Send for Bulletin 306. Troy Engine & Machine Co.

TOOLS AND SMALL SPECIALTIES

114—See page 128. Pipe Cutting Tools: New catalog, Number S-48, is free for the asking. Contains full information about these improved pipe tools. Send for your copy now. Armstrong Bros. Tool Co.

115—See page 6. Proto Tools: That's the new name for Plomb Tools, the leading brand of mechanics' hand service tools. Write for your copy of complete catalog showing this old, reliable line of tools with the new name. Plomb Tool Company.

116—See page 144. Adjustable Tube Expanders: Complete information available on request for these expanders specially designed for expanding tubes, condensers, heat exchangers, and similar units. The Gustav Wiedeke Company.

(Continued on page 159)

COCHRANE RAPID REACTORS

PROVIDING THOROUGH HIGH SPEED WATER CONDITIONING at the Paulsboro Refinery of Socony-Vacuum

Increased production is the keynote for the petroleum industry these days, and typical of the industry's efforts to get this increased production is the expansion and modernization program just completed at the Paulsboro, N. J. refinery of the Socony-Vacuum Oil Company, Inc. Naturally this modernization comprises the last word in modern equipment to insure consistently high production —including Cochrane Rapid Reactors for the treatment of one of the most vital raw materials—water.

Water for use in the refining processes at Paulsboro is drawn directly from the Delaware River and introduced into the Cochrane Rapid Reactors in a raw state. The raw water is combined with chemical reagents and preformed precipitates—thoroughly agitated, and passed into an integral settling and thickening reservoir where it is collected for further treatment. Consistent with the quickened pace of this modern refinery, the Rapid Reactor completes all four of the major water conditioning operations, and does them more efficiently, in a fraction of the time required by other cold process softening methods.

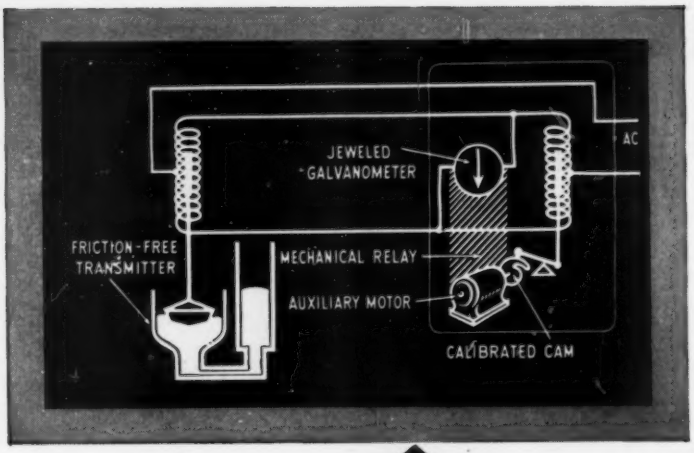
Speed and efficiency are but two of the advantages of Cochrane Rapid Reactors. Original cost is low because of the simple compact design. Operating costs are held to a minimum—a saving effected by more efficient use of chemicals. Water treatment is thorough and consistent because of large recirculation volume, automatic chemical feed and sludge blowoff, and thorough mixing. The Rapid Reactor is conservative in requirements for valuable space because of its high liquid velocities.

Cochrane Rapid Reactors are finding wide acceptance wherever raw water clarification or softening is a problem. Write today for the full story of this versatile softening equipment.

COCHRANE CORPORATION 17th Street below Allegheny Avenue, PHILADELPHIA 32, PA.

COCHRANE

RAPID REACTORS • HOT PROCESS SOFTENERS
DEAERATORS • ZEOLITE SOFTENERS
FILTERS • CONTINUOUS BLOWOFF SYSTEMS
DEMINERALIZERS • STEAM SPECIALTIES



tops!...FOR ACCURACY,

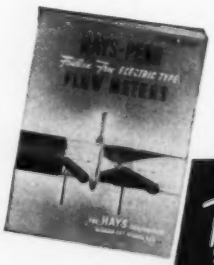
READABILITY, LOW MAINTENANCE .... FLEXIBLE USEFULNESS ....

HAYS-PENN Flow Meter

Extreme accuracy *that stays accurate* is the chief characteristic of the Hays-Penn Flow Meter; and the "reason why" is exceedingly simple:

- the friction-free float transmitter serves only as a pilot—does no work of recording—actuates the auxiliary motor which does the work of operating the recording pen, indicator and integrator

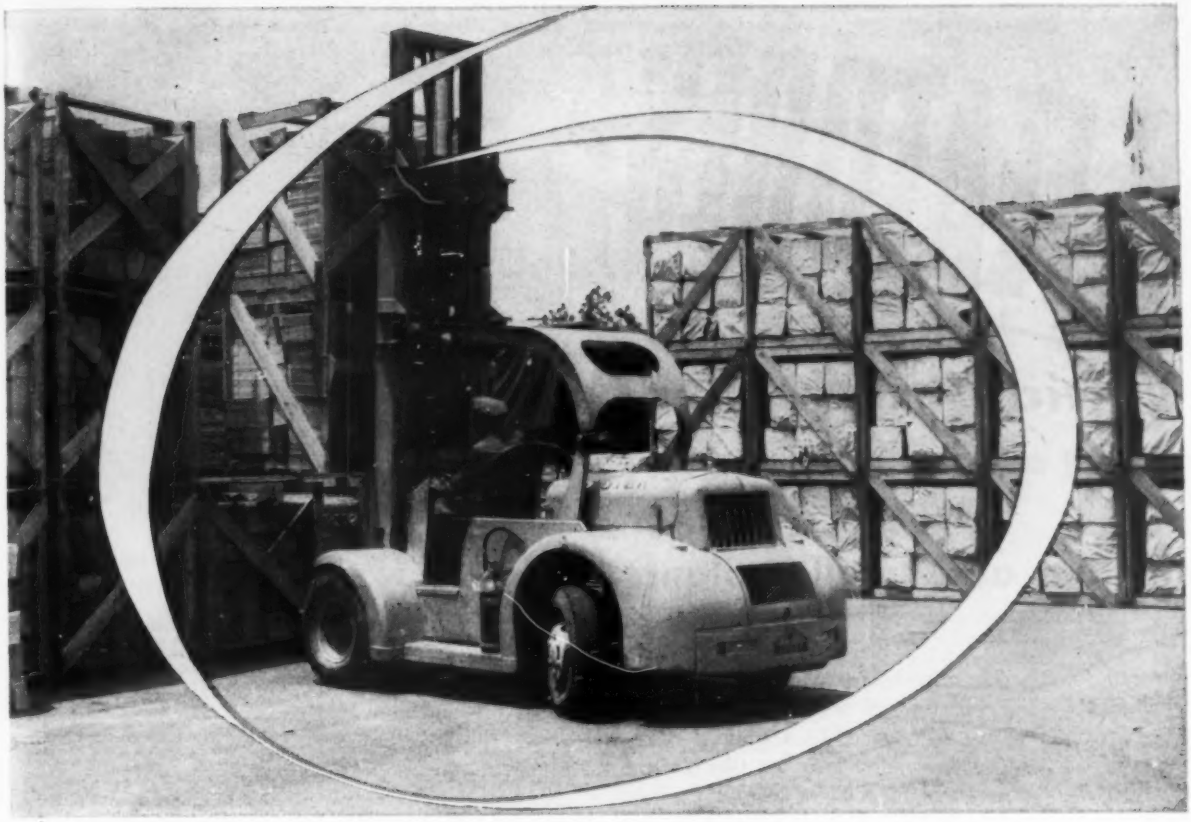
No stuffing boxes, no bearings, no electric contacts, no solenoid reactions—that is why Hays-Penn Flow Meters maintain their matchless accuracy through long periods with a minimum of maintenance. Hays-Penn Flow Meters are made for every metering need.



Write for Publication 47-800

THE HAYS CORPORATION
MICHIGAN CITY 2, INDIANA

THE HAYS CORPORATION
Since 1901 COMBUSTION & INDUSTRIAL INSTRUMENTS & CONTROL
MICHIGAN CITY, INDIANA, U.S.A.



HYSTER 150...*King of Lift Trucks*

HERE'S THE HYSTER that has *worked* its way to the top by cutting costs in the MANUFACTURING INDUSTRIES. 15,000 lb. capacity. Handles anything. Pneumatic tires. Easy on the operator. Heavy duty gasoline engine. Full hydraulic braking system. 17½ ft. lift to underside of load on 42 in. load arms. Hoists, transports, tiers heavy or bulky loads—inside or outside. Want a demonstration? Or a list of users? See your Hyster distributor.

Hyster manufactures 7 lift truck models, which have capacity ranges from 2,000 lbs. to 30,000 lbs. All are equipped with pneumatic tires. Write for literature.

HYSTER® COMPANY

THREE FACTORIES

2958 N. E. CLACKAMAS, PORTLAND 8, OREGON
1858 NORTH ADAMS ST., PEORIA 1, ILLINOIS
1058 MEYERS STREET...DANVILLE, ILLINOIS

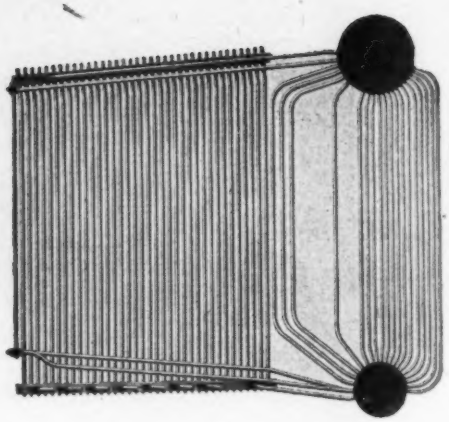
6 FEATURES of the Vertical-Unit Boiler that assure low-cost steam for medium and smaller plants

Illustrated and briefly described on these pages are the principal design features which account for the widespread popularity of C-E Vertical-Unit Boilers. Introduced originally by Combustion in 1926, this general design proved so successful that it has long since become the accepted standard for a very wide range of steam requirements.

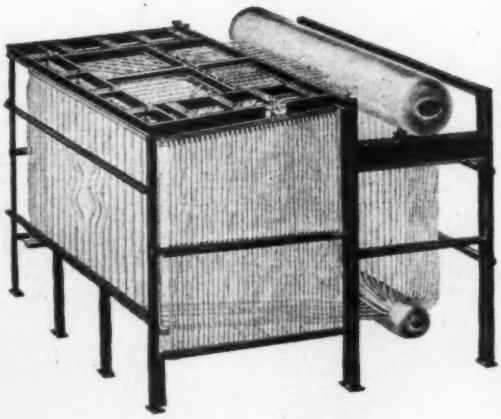
The unit shown—the VU-50—is but one of a family of such boilers developed to serve a complete range of steam needs. Unit capacities range from 10,000 to 350,000 lb of steam per hr with pressures up to 1,000 psi and total steam temperatures to 900 F, or higher. There are Vertical-Unit Boilers suitable for all methods of firing, including pulverized coal, all types of stokers and oil or gas; also for combinations of these fuels.

Compare its features item by item with those of any similar equipment on the market. They make it easy to understand why VU Units with an aggregate capacity of more than 100,000,000 lb of steam per hr have been purchased to date.

B-321B



Symmetrical Design. Any section taken through the unit from the front to rear is similar to any other section so taken. Each elemental section includes the same amount of furnace volume, the same amount of boiler heating surface and the same amount of superheater surface as any other. The volume of gases, their velocity and temperature, at any point from front to rear, are practically constant across the width of the unit.



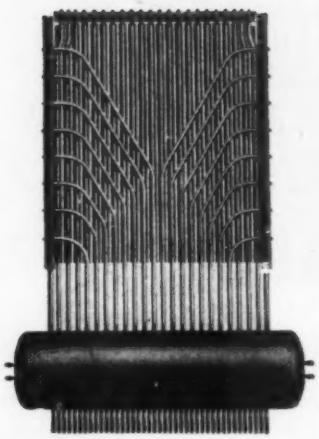
Overhead Suspension. Complete freedom of expansion in all directions is provided by suspension of all parts of the unit from the steel structure which provides the framework for the outer steel casing. This feature makes ample provision for the effects of temperature changes; it eliminates abnormal mechanical stresses on all pressure parts and explains to a large degree the freedom of the VU Unit from leaky joints.

COMBUSTION ENGINEERING—SUPERHEATER, INC.

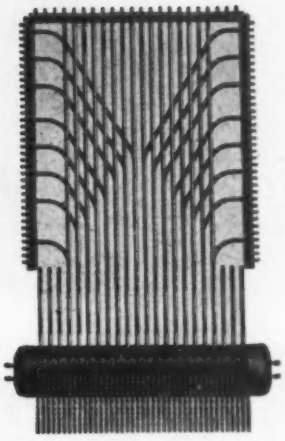
A Merger of Combustion Engineering Co., Inc. and The Superheater Co.

200 Madison Avenue · New York 16, N. Y.

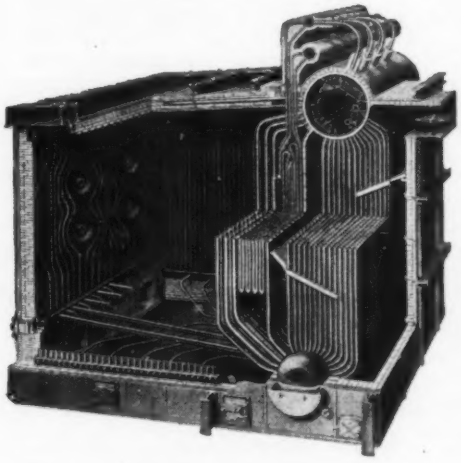
ALL TYPES OF BOILERS, FURNACES, PULVERIZED FUEL SYSTEMS AND STOKERS; ALSO SUPERHEATERS, ECONOMIZERS AND AIR HEATERS



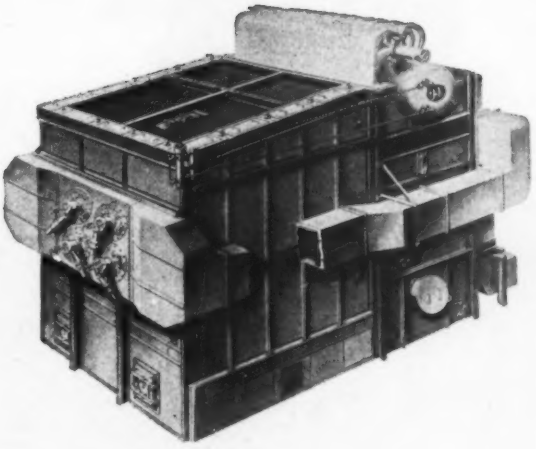
Quality Steam. All of the most active steam producing tubes enter a baffled area in the drum which discharges well above the normal water line and uniformly across the full length of the drum. This arrangement reduces turbulence to a minimum and permits effective utilization of the entire steam release space. Dry steam and a stabilized water level are thus assured even under adverse conditions.



Standardized Construction. Painstaking refinement of detail is incorporated in each unit at a small fraction of the original engineering cost. With standard parts and structural features the merits of which are confirmed by experience, manufacturing and erection costs are materially reduced. First cost reflects the economies of standardization and the buyer benefits even before the VU Unit is placed in operation.

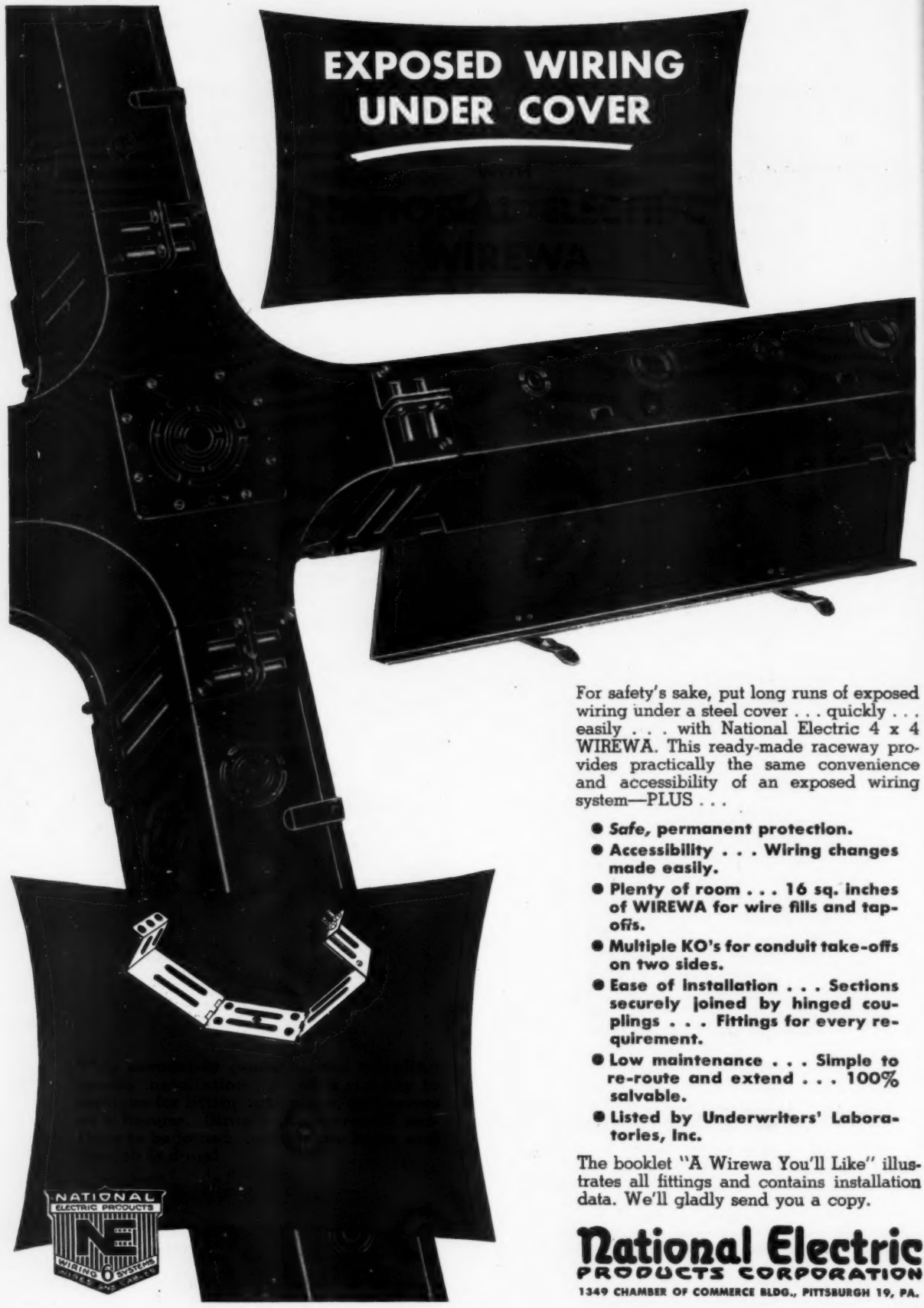


Adaptable In Application. The VU Unit can be adapted, without sacrifice of the benefits of standardization, to a great variety of conditions: where space limitations are imposed; to burn coal, oil, gas or any combination of these fuels; to meet widely varying requirements of load, pressure and temperature. Inclusion of inter-bank or inter-tube superheater or an air heater is easily accomplished as conditions require.



Steel Encased Setting. The unit setting of shaped tile, refractory and 100% insulation are attractively finished by a permanent outer steel casing. This design, evolved from careful study and experiment, reduces to a minimum heat losses caused by radiation and air infiltration. It tends to eliminate hot spots and helps maintain a uniformly low surface temperature throughout the steel casing. Maintenance is negligible.

EXPOSED WIRING UNDER COVER



For safety's sake, put long runs of exposed wiring under a steel cover . . . quickly . . . easily . . . with National Electric 4 x 4 WIREWA. This ready-made raceway provides practically the same convenience and accessibility of an exposed wiring system—PLUS . . .

- ***Safe,* permanent protection.**
- **Accessibility . . . Wiring changes made easily.**
- **Plenty of room . . . 16 sq. inches of WIREWA for wire fills and tap-offs.**
- **Multiple KO's for conduit take-offs on two sides.**
- **Ease of installation . . . Sections securely joined by hinged couplings . . . Fittings for every requirement.**
- **Low maintenance . . . Simple to re-route and extend . . . 100% salvable.**
- **Listed by Underwriters' Laboratories, Inc.**

The booklet "A Wirewa You'll Like" illustrates all fittings and contains installation data. We'll gladly send you a copy.

National Electric
PRODUCTS CORPORATION
1349 CHAMBER OF COMMERCE BLDG., PITTSBURGH 19, PA.

These turbine lubrication savings can be yours . . .

Simply by your choice of turbine oil, you can eliminate the cost, the time and the labor of replacing turbine oil. You can eliminate also the need for removing turbine oil for treating and the need for cleaning oil systems. Evidence that you can make these savings is supplied by S. H. Smith, superintendent of the Board of Public Works, South Haven, Michigan. He reports:

"When the first of our three present turbines was installed in 1936, we filled it with Nonpareil Turbine Oil. This practice was followed with each of the other two turbines. *In 13 years' use of Nonpareil, we have had no shutdowns resulting from dirty oil or from the necessity of replacing oil.* It has not been necessary to clean the oil. Semi-annual tests have shown that the oil has not deteriorated in any way."

Your switch to Nonpareil Turbine Oil will insure safe and economical lubrication, not only for 13 years, but for the *life* of your turbines. You receive with each fill of Nonpareil a written

NONPAREIL
Turbine Oil

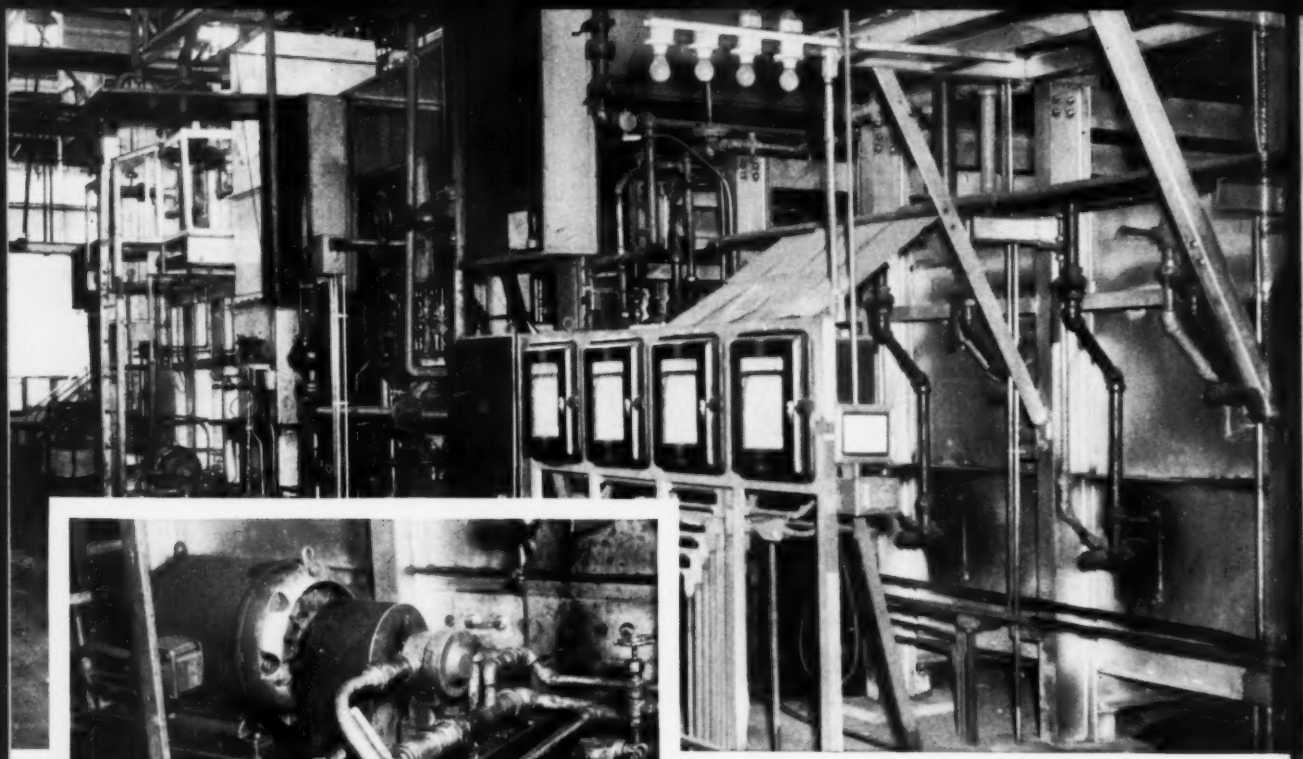
"WILL OUTLAST YOUR TURBINE"

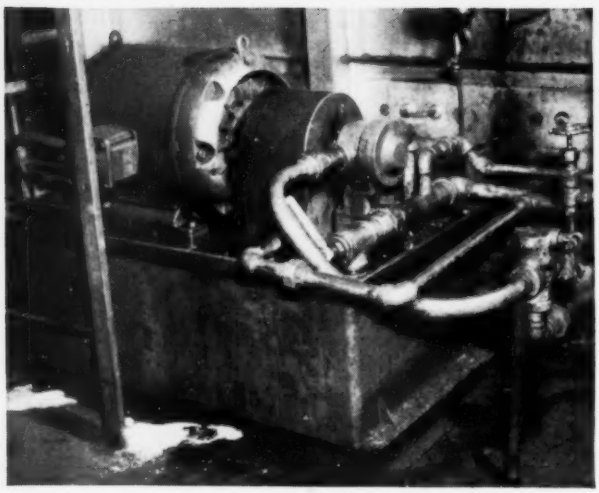
guarantee that the oil will last as long as the turbine and that its acidity will stay below a neutralization number of 0.15 mg. KOH/gm. Find out from a Standard Oil Lubrication Engineer how Nonpareil has lived up to its guarantee, how it has reduced utility lubrication costs as much as 68%.

Write Standard Oil Company (Indiana), 910 South Michigan Avenue, Chicago 80, Illinois.

STANDARD OIL COMPANY (INDIANA) STANDARD

35





STANOIL
Industrial Oil

How to make your hydraulic operations more reliable

EQUIPMENT like that shown above is used for hardening automotive crankshafts in a midwest plant. Each unit consists of a hardening furnace and an automatic quench tank. Hydraulic units, operating through panel control boxes, move the crankshafts through the furnaces and tanks at prescribed depths and at fixed time cycles.

Because of manufacturing requirements, hydraulic units must operate continuously without shutdown for cleaning. At the same time, they must function perfectly to permit accurate control of furnace operations.

Stanoil 15 has enabled the hydraulic units to meet fully these two stringent demands. There have been no difficulties due to stuck valves. The hydraulic units have responded smoothly and promptly to controls. Oil systems have remained clean and free from deposits.

You can rely on Stanoils to give you the same clean, dependable operation of hydraulic units and of speed reducers and circulating systems as well. These unique, multi-purpose oils can replace many special and costly oils in your plant. A Standard Oil Lubrication Engineer will be glad to help you obtain the most economical use of Stanoil.

If your plant is located in the Midwest, write Standard Oil Company (Indiana), 910 South Michigan Avenue, Chicago 80, Illinois, to secure the services of the Engineer nearest you.

STANDARD OIL COMPANY (INDIANA)

STANDARD

Roof-Top Storage for Coal

A unique and convenient method for live storage of coal is used by this modern power plant located on French Island in the Black and LaCrosse Rivers. Roof-top storage bins fed by weatherproof REDLER conveyor-elevators are the standout feature of this compact system designed by S-A engineers for low-cost coal handling.

For nearly half a century S-A engineers have been designing and installing coal and ash handling systems for every kind of industry. From this wealth of experience have come constant improvement both in equipment and in methods.

Put these years of experience of S-A engineers to work on your coal and ash handling problems. Their recommendations will assure you maximum handling efficiency at lowest cost per ton. Write today.

Coal is picked up from double track hopper by pan feeder which moves it to loop-boot feed section of 97 ft. high REDLER elevator. By means of a gate regulated two-way spout, elevated coal is fed into two inclined REDLER elevators, each of which discharges into separate 180-ton capacity storage bins on roof of boiler house. Coal is spouted by gravity into stoker hoppers. Handling capacity of this S-A designed REDLER system is 60 TPH.

STEPHEN S-A ADAMSON MFG. CO.

21 Ridgeway Avenue, Aurora, Illinois — Los Angeles, Calif. • Belleville, Ontario

DESIGNERS AND MANUFACTURERS OF ALL TYPES OF BULK MATERIALS HANDLING EQUIPMENT

pg. missing

"We stopped motor burn-outs and saved time and money for a large company..."

by Installing..

"Recently, while rewiring part of a large manufacturing plant here in Salem, we installed Fusetron dual-element fuses in motor-running protection size to back up the overload protection already installed on the motors.

"On several occasions, for some reason, these protectors failed to operate when they should have and the motor would have burned out except for the opening of the Fusetron fuses.

"The company's plant engineer was so impressed by the way these Fusetron fuses prevented damage to the motors and saved the company time and money that he authorized us to install Fusetron fuses throughout the entire plant."

Howard Firestone. Owner
FIRESTONE ELECTRIC COMPANY,
Salem, Ohio

Facts About FUSETRON Dual-Element Fuses

The fuse link element opens on short-circuit — the thermal cutout element protects on overloads — the result, a fuse with tremendous time-lag and much less electrical resistance.

They have the same degree of Underwriters' Laboratories approval for both motor-running and circuit protection as the most expensive devices made.

Made to the same dimensions as ordinary fuses — fit all standard fuse holders.

Obtainable in all sizes from 1/10 to 600 ampere, both 250 and 600 volt types. Also in plug types for 125 volt circuits.

Their cost is surprinsingly low.

(FUSETRON is a trade mark of the Bussmann Mfg. Co., Division of McGraw Electric Co.)

Fusetron DUAL-ELEMENT Fuses

with their

10 Point Protection

1. Protect against short-circuits.
2. Protect against needless blows caused by harmless overloads.
3. Protect against needless blows caused by excessive heating — lesser resistance results in much cooler operation.
4. Provide thermal protection — for panels and switches against damage from heating due to poor contact.
5. Protect motors against burnout from overloading.
6. Protect motors against burnout due to single phasing.
7. Give DOUBLE burnout protection to large motors — without extra cost.
8. Make protection of small motors simple and inexpensive.
9. Protect against waste of space and money — permit use of proper size switches and panels.
10. Protect coils, transformers and solenoids against burnout.

Stop Wasting Time and Money-

FUSETRON
TRUSTWORTHY NAMES IN ELECTRICAL PROTECTION
BUSS

FUSETRON Dual-Element Fuses Give ALL-PURPOSE PROTECTION

One needless shutdown — or one lost motor — or one destroyed switch or panel — may cost you far more than replacing every ordinary fuse with a FUSETRON dual-element fuse.

Don't risk such losses — protect yourself by installing a FUSETRON dual-element fuse in every set of fuse clips throughout the entire electrical system.

Bussmann Mfg. Co., University at Jefferson
St. Louis 7, Mo. (Division McGraw Electric Co.)

Please send me complete facts about FUSETRON dual-element Fuses.

*Name*_____

*Title*_____

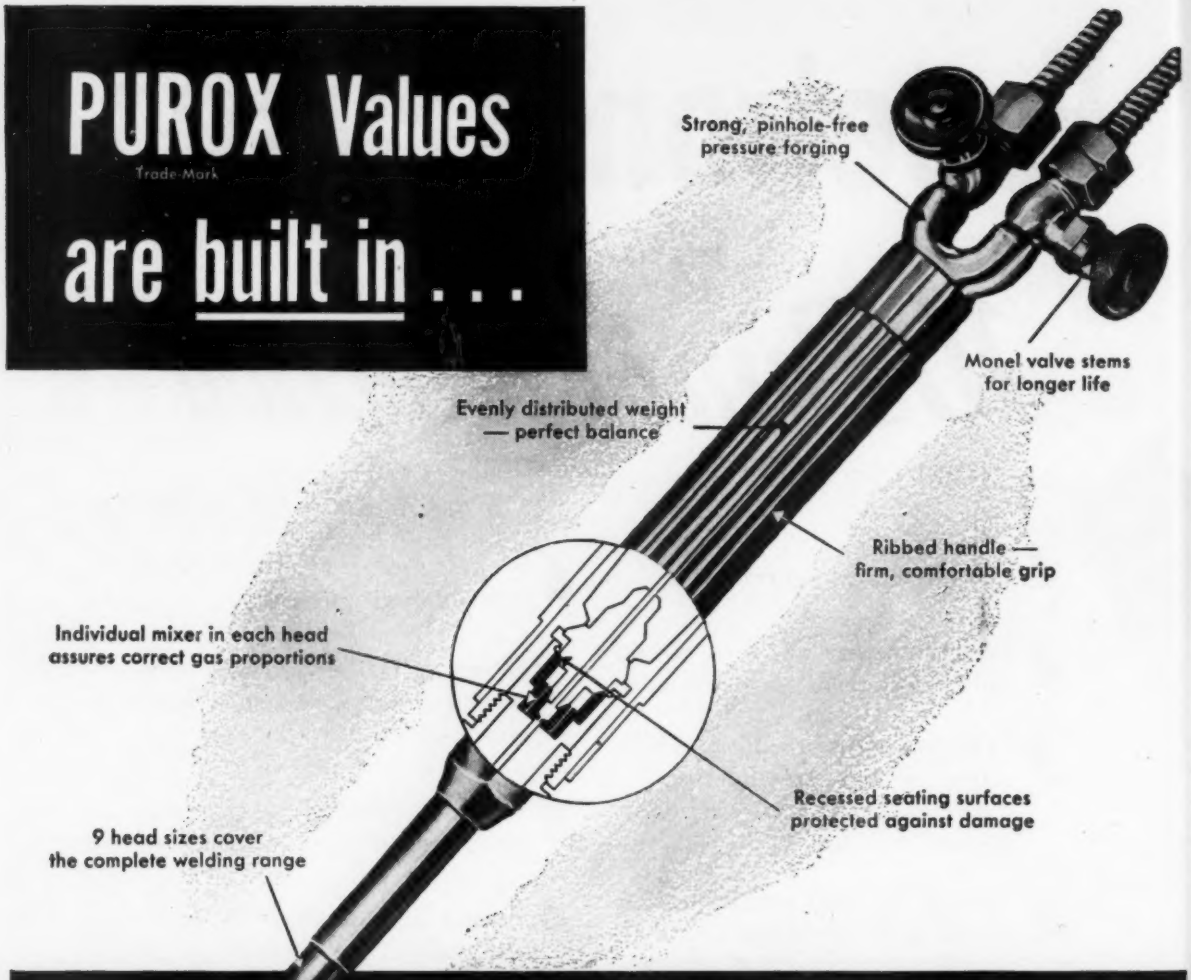
*Company*_____

*Address*_____

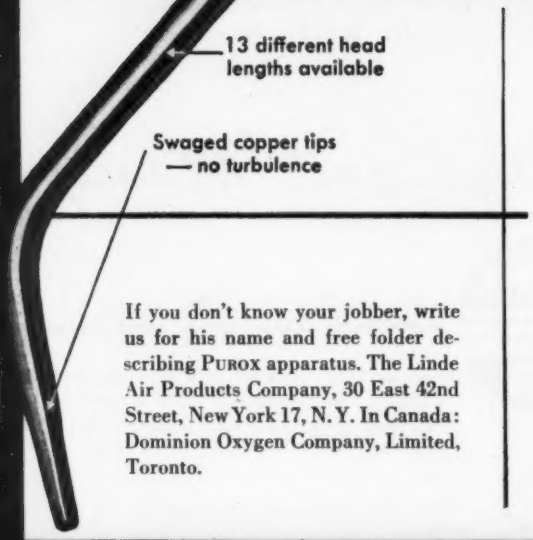
*City & Zone*_____ *State*_____ 150

PUROX Values are built in . . .

Trade-Mark


Strong, pinhole-free pressure forging
Monel valve stems for longer life
Evenly distributed weight — perfect balance
Ribbed handle — firm, comfortable grip
Individual mixer in each head assures correct gas proportions
Recessed seating surfaces protected against damage
9 head sizes cover the complete welding range

ALL-PURPOSE WELDING BLOWPIPE — No. 35



If you don't know your jobber, write us for his name and free folder describing PUROX apparatus. The Linde Air Products Company, 30 East 42nd Street, New York 17, N. Y. In Canada: Dominion Oxygen Company, Limited, Toronto.

The PUROX No. 35 Blowpipe covers a complete welding range, from 28-gage sheet to plate over 1 inch thick. An all-purpose blowpipe — *with special capacity for continuous heavy work* — it is first choice of experienced operators who *know* welding and cutting equipment.

PUROX blowpipes are products of The Linde Air Products Company, a Unit of Union Carbide and Carbon Corporation. You can rely on them for long, dependable service under *any* operating conditions. Their efficient design and high standards of workmanship are based on LINDE's skill and practical experience in the oxy-acetylene field.

Order from your local Jobber

The term "Purox" is a trade-mark of Union Carbide and Carbon Corporation.

when you want...

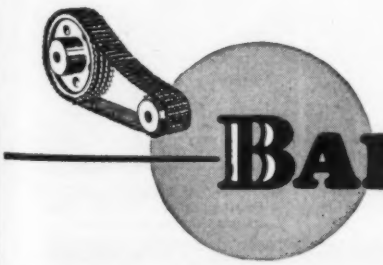
positive power • Roller Chains deliver positive power for the lifetime of the drive. No power is wasted through slippage . . . speed ratios are fixed.

shock absorbing ability • Roller chains have an inherent elasticity that assures a high degree of shock-absorbing ability. This elasticity, plus the chain catenary and the cushioning effect of the oil film between working parts, protects driven equipment against shocks of pulsating loads.

durability • With roller chains, the working loads are not concentrated on a single sprocket tooth. Thus, each tooth carries its part of the load, assuring longer life. There is no pre-load to affect bearing and chain life since roller chains are not dependent on tension for effective operation.

rely on Roller Chains

For information on roller chains and how they can help you, see your Baldwin-Rex Distributor or write for your copy of Bulletin No. 48-1. Baldwin-Duckworth Division of Chain Belt Company, 388 Plainfield Street, Springfield 2, Mass.



BALDWIN·REX ROLLER CHAINS

A complete line from ¼-inch to 2½-inch pitch

BALDWIN-DUCKWORTH DIVISION OF CHAIN BELT COMPANY

Thread 2″ pipe in 22 seconds with TOLEDO POWER PIPE MACHINES!

● *You can save up to 80% on pipe threading time*—by using a portable TOLEDO No. 999 Power Pipe Machine instead of hand methods! This saves labor... reduces costs!

The Super Model threads 2″ pipe in 22 seconds... or 30 seconds with Standard Model. Cuts off 2″ pipe in 10 seconds. Combines speed, production, strength, compactness, portability, dependability and low cost! Ask your distributor for complete details and price. Write for new catalog. The Toledo Pipe Threading Machine Co., Toledo, Ohio. New York Office: 165 Broadway, Room 1310.

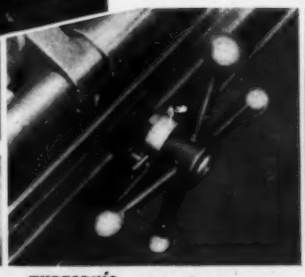
RELY ON THE LEADER

TOLEDO

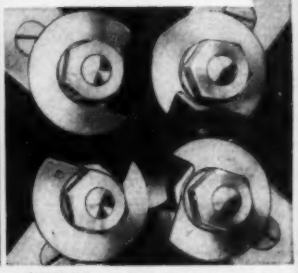
FOR PRECISION PIPE TOOLS

CONTROLS... entirely within forward and reversing switch. Speed adjusted automatically.

REAMING... with 12 tooth cone type fluted reamer mounted on arm on cutter head.



THREADING... speedy, accurate. Thread gauge shows length of thread being cut.



CUTTING... especially fast with 4 cutting knives. Perfect square end cuts. No burred edges.

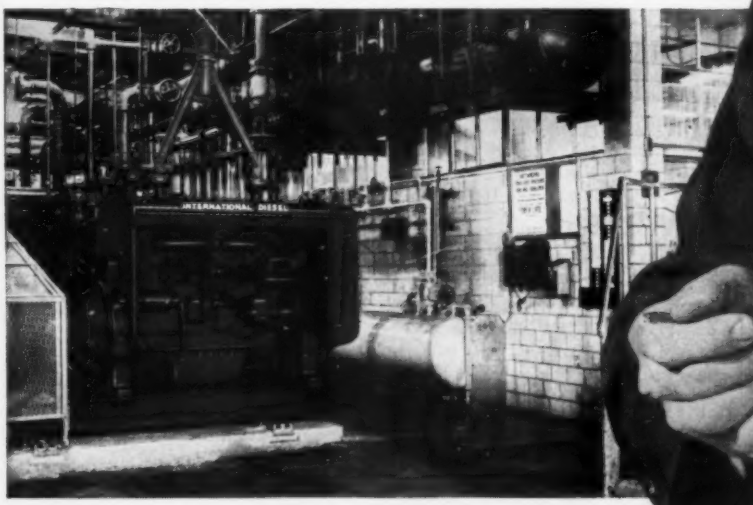
DAILY DIVIDEND

Profits are produced by low costs and low cost power is a daily dividend delivered by International Power.

That's why a metropolitan dairy and ice cream plant chose International Diesels to drive the compressors. Years of operation here have proved that dependable Internationals cost less than any other source of power.

Here's how to get a daily diet of dividends from your power. See your International Power Unit dealer —we'll tell you where to find him if you don't already know—and let him show you how the right size International Power Units will shrink your power costs.

INTERNATIONAL HARVESTER COMPANY • Chicago



The Weissglass Gold Seal Dairy Corp. of Staten Island, N. Y., finds their daily diet of International Power pays dividends. "We intend to stay with Internationals and so equip all our plants accordingly as we go along. We have six International power units in all—all are doing a fine job, especially the one in our creamery. All of them operate very economically." —(Signed) Joseph Weissglass.

CRAWLER TRACTORS
WHEEL TRACTORS
DIESEL ENGINES
POWER UNITS

INTERNATIONAL HARVESTER

INTERNATIONAL INDUSTRIAL POWER

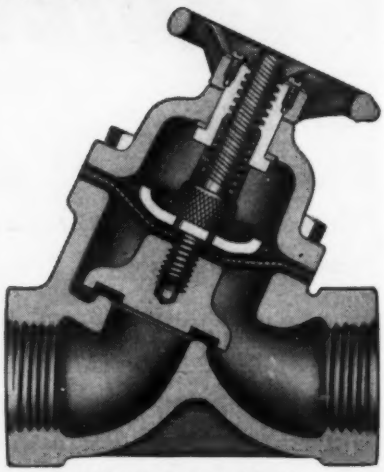
Piping equipment for every system... from one complete line

FOR BETTER CONTROL OF HARD-TO-HOLD FLUIDS

Crane Diaphragm Valves—in plain iron or Neoprene-lined types—are ideal for conveying compressed air, compressed or liquefied gases, volatile and corrosive fluids. Crane separate disc-diaphragm construction—a revolutionary improvement in packless valve design—makes these new valves safer, more durable, more efficient.

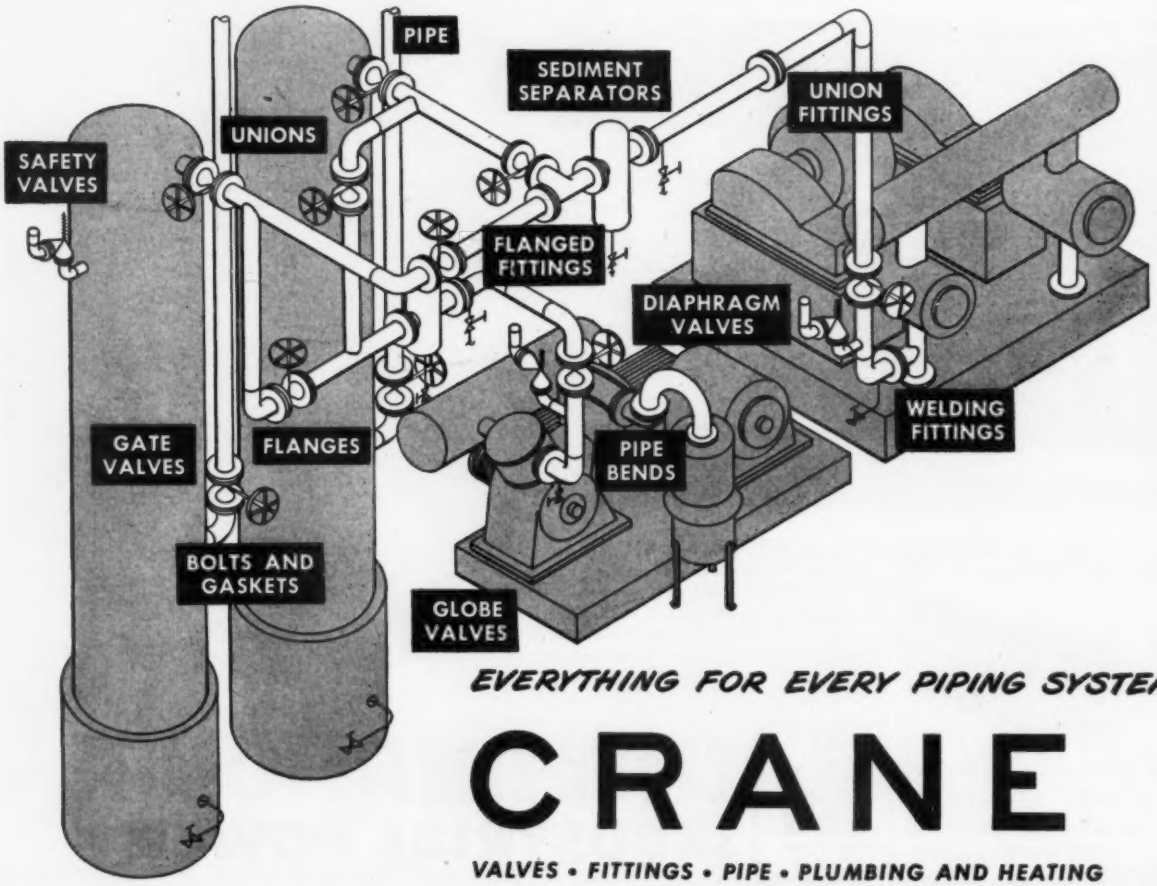
On Crane valves, the diaphragm is used only to seal the bonnet . . . is not subject to cutting, crushing and rapid wear. A separate circular disc permits positive shut-off even should the diaphragm fail. Y-pattern body design assures greater flow capacity, minimizes pressure drop. Crane separate disc-diaphragm design reduces appreciably the torque required to operate these valves. For further information, WRITE FOR CIRCULAR AD-1761.

CRANE CO., 836 S. Michigan Ave., Chicago 5, Ill.
Branches and Wholesalers Serving All Industrial Areas



WORKING PRESSURES:
Up to 150 pounds water, oil, air or gas—180° F. max. temp. Sizes up to 6 in. Screwed or flanged ends.

ONE ORDER TO CRANE COVERS ALL PIPING NEEDS . . .
FOR THIS AIR COMPRESSOR INSTALLATION, FOR EXAMPLE



EVERYTHING FOR EVERY PIPING SYSTEM

CRANE

VALVES • FITTINGS • PIPE • PLUMBING AND HEATING

INDUSTRIAL TYPES
all
WESTON
all-Metal
THERMOMETERS
For all *usual* industrial temperature requirements, WESTON thermometers have been widely adopted because of their all-metal ruggedness, their readability, their long-time accuracy and low overall cost. And these same advantages are available for *unusual* temperature needs, too; in WESTON models designed for alarm or control applications—for indicating highest or lowest temperatures reached since last setting—for precise laboratory requirements. Be sure you have all the facts on the complete line. Ask your jobber or local WESTON representative, or write direct for literature. WESTON Electrical Instrument Corporation, 637 Frelinghuysen Avenue, Newark 5, New Jersey.
CONTACT-MAKING
MAX-MIN MODELS
LAB THERMOMETERS
WESTON Instruments

PLUGS ARE OUT WITH CHLORINATION

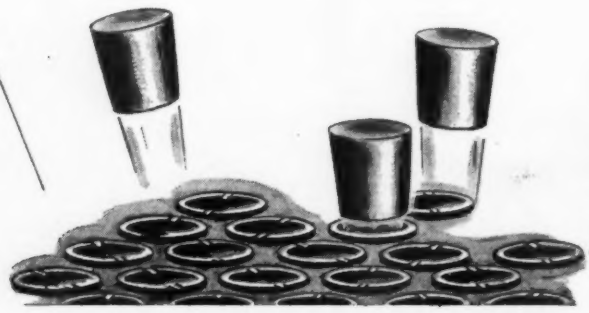
Costly plug cleaning, with its high labor bills and lengthy equipment down-time, goes out of the condenser and heat exchange picture the minute chlorination arrives.

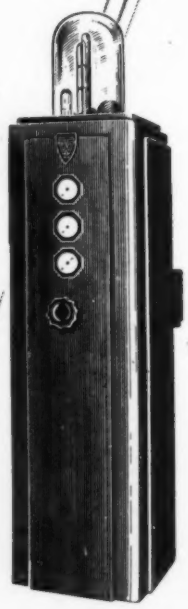
This proven process for cutting the costly effects of back pressure and poor heat transfer characteristics caused by slime, really works, as one Southern Power Station found out when they began using the W&T De-sliming Process. In just six months after W&T Chlorinators were installed, cleaning and excess steam costs were reduced from $1450 per month to $250 per month and a later survey showed an overall saving in excess steam costs of $16000 in a year.

Such savings are indicative of how your condensers may be made to operate more economically and with far less outage when W&T Engineers install chlorination to fight your slime problems.

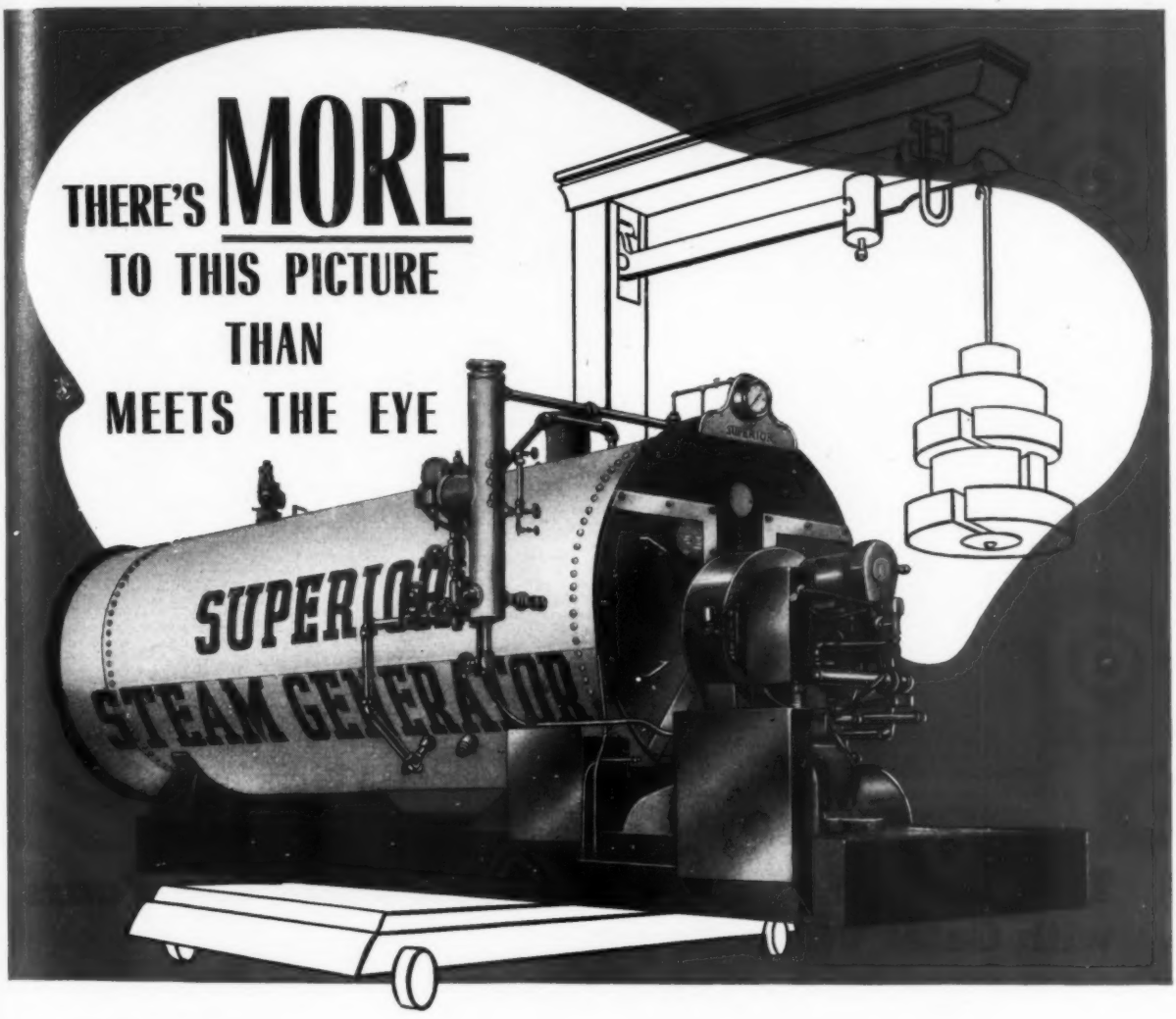
To learn how chlorination may be profitably applied to your heat exchange equipment and to take advantage of W&T's 35 years' experience, write today.

WALLACE & TIERNAN
PRODUCTS, INC.
CHLORINE AND CHEMICAL CONTROL EQUIPMENT
Belleville 9, New Jersey • Represented in Principal Cities





CD-31



What's this . . . steam generators by the pound?

But doesn't it make sense that greater heating surface and larger steaming areas go hand-in-hand with increased weight? And doesn't sturdy, rugged, built-for-life construction add even more weight?

Of course it does . . . and that's a thought which tips the balance with consulting engineers who specify *Superior* Steam Generators. For after weighing all the factors of unit purchase with undivided responsibility, completely automatic operation with any kind of oil or gas, induced draft which eliminates the need of a chimney, simple installation, and guaranteed thermal efficiency in excess of 80% . . . after all this, specifying engineers look for long-lived dependability . . . and find it in Superior's rugged construction, ample steam space and larger heating surfaces . . . the features which make Superior Steam Generators weigh more.

Superior Steam Generators are available in capacities from 20 to 500 b. h. p. for pressures up to 250 p. s. i. For complete details write for catalog 202.

uperior ombustion ndustries, inc.

Factory: Emmaus, Pa.
Executive Offices: Times Building, Times Square, New York 18, N. Y.

This Gates Vulco Rope Drive has an unusual task. It revolves a 12-foot, 55-ton Drying Roll in a Roll Grinder at about one R.P.M. The double-reduction V-Belt Drive replaced gears because even at this slow speed the backlash of the gears resulted in chatter marks on the surface of the roll. The resilience of the Gates Vulco Ropes results in a smooth, mirror-like surface on the rolls.

Two Distinct *Savings* in *V-Belt Costs* Are *Yours* with Gates Vulco Ropes

A simple test that takes less than two minutes will save you many dollars in V-Belt costs. Here it is—

Have someone bend a V-Belt exactly as it bends in going around its pulley. As it bends, grip its sides with your fingers. You will *feel* those sides *change shape.* In a straight-sided V-Belt, the sides become *convex* as the belt bends. And note how the sides *bulge out.* (Figures 1 and 1A)

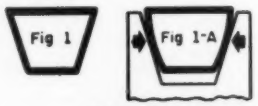
Now try the same test with a V-Belt that is built with the concave side. You will feel a change in shape—but a *different result!* The sides do not become *convex.* Instead, they become perfectly straight. *The bent belt now has a shape that exactly fits its sheave groove*—as shown in Figures 2 and 2A.

Two distinct savings result. *First*—There is no side-bulge to cause uneven wear. The sides press *evenly* against the V pulley and therefore wear *uniformly*—resulting in *longer life!* Second—The *full width* of the sidewall grips the pulley—thus carrying heavier loads without slippage—and this *saves belts* and also saves *power!*

When you buy V-Belts, be sure you get the V-Belt with the Concave Sides... the Gates Vulco Rope!

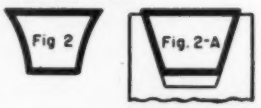
What Happens When a V-Belt Bends

Straight-Sided V-Belt



How Straight-Sided V-Belt Bulges in Sheave-Groove.

Gates Vulco Rope with Concave Side.

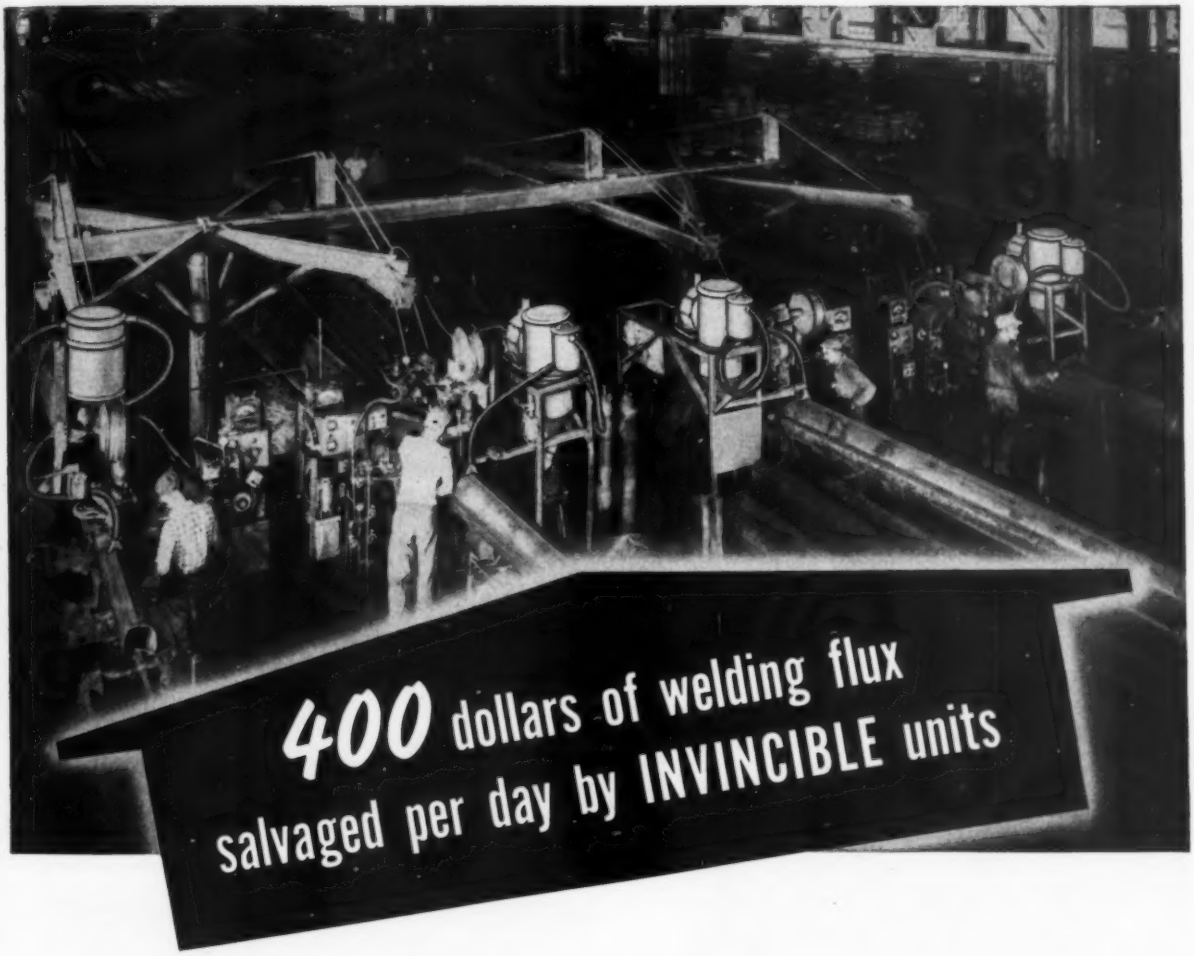


No Side Bulge. Precise Fit in Sheave Groove.

C. S. 301

THE GATES RUBBER COMPANY
DENVER, U.S.A.
The World's Largest Makers of V-Belts

GATES VULCO ROPE DRIVES
Engineering Offices and Jobber Stocks IN ALL INDUSTRIAL CENTERS of the U. S. and 71 Foreign Countries



Steel street lighting standards totaling almost three miles in length can be welded in a day by The Union Metal Mfg. Co., Canton, Ohio. A battery of five Invincible Flux Recovery Units *automatically* salvages the unfused flux from this submerged arc welding. The flux recovered in a three shift operation is valued at four hundred dollars.

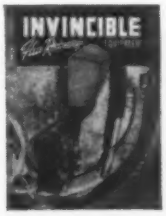
Manual salvage would involve many costly man-hours, and the probability of less efficient separation of the re-usable flux from the fused particles and fine dust.

Working practically 'round the clock for over four years, these Invincibles have required a minimum of repairs, even though the material handled is highly abrasive.

Available in many sizes and types, the complete line of Invincible Recovery Units offers the *right* model for every kind of submerged arc welding job...To apply the equipment to your needs, Invincible's unexcelled experience in this specialized field is at your service.

Free Folder on Flux Recovery

Describes and illustrates the complete Invincible line ...Send for your copy *now.*



INVINCIBLE VACUUM CLEANER MFG. CO.
DOVER, OHIO
FOR 40 YEARS, LEADERS IN INDUSTRIAL VACUUM EQUIPMENT

HANDLE IT *MECHANICALLY*

Jeffrey mold conveyor (above) — pouring operation to shake-out. Other foundry equipment includes: flask fillers, aerators, sandi-tioners, feeders, crushers, conveyors and bucket elevators.

Jeffrey spiral conveyors (above) — serving a large cement plant.

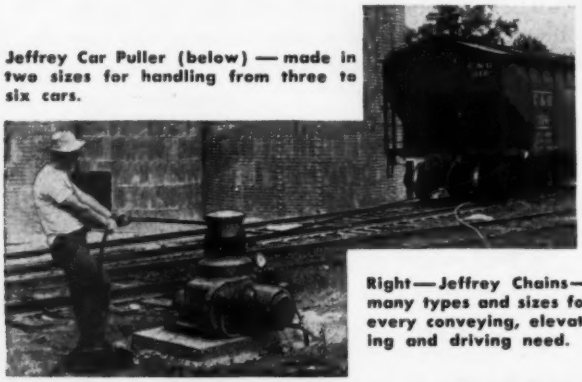
Right — Jeffrey-Traylor electric vibrating feeder regulating feed to Jeffrey Hammermill. Also electric vibrating barrel packers, conveyors, coolers, dryers and screens.

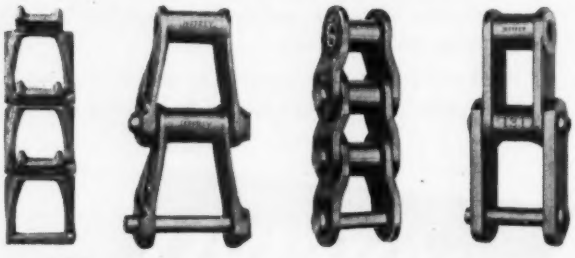
Jeffrey belt conveyor (above) feeding a Jeffrey bucket elevator in large quarry operation.

Above Right — Jeffrey leak-proof steel apron conveyor handling coal in power plant.

Jeffrey electric vibrating pan feeder (above) — controlled feed from a few ounces to many tons per hour.

Jeffrey Car Puller (below) — made in two sizes for handling from three to six cars.





Right — Jeffrey Chains — many types and sizes for every conveying, elevating and driving need.

THE JEFFREY MANUFACTURING COMPANY

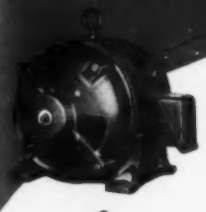
814 North Fourth St., Columbus 16, Ohio

Baltimore 2	Chicago 1	Detroit 13	Jacksonville 5	Pittsburgh 22
Birmingham 3	Cincinnati 2	Harlan	Milwaukee 2	St. Louis 1
Boston 16	Cleveland 13	Houston 2	New York 7	Salt Lake City 1
Buffalo 2	Denver 2	Huntington 19	Philadelphia 3	Scranton 3

There's a Century MOTOR To Supply Dependable Power For All Popular Applications

Century motors are available in sizes from 1/6 to 400 horsepower, in a wide range of types and kinds—single phase and polyphase alternating current, and direct current. All of them are ruggedly built to assure top performance throughout a long service life.

POLYPHASE

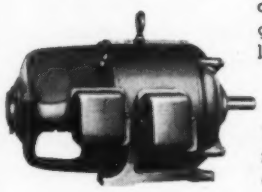


Type SC—OPEN PROTECTED—Form J, general purpose motor—meets the needs for most installations where operating conditions are relatively clean and dry. The top half of the motor frame is closed to keep out falling solids or dripping liquid.

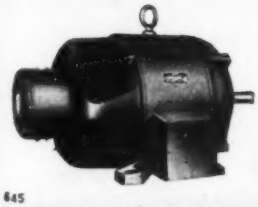
Type SC—SPLASH PROOF—gives the necessary protection where plants must be washed down—keeps water out of the motor even when a hose is applied directly on the frame. Also provides protection against rain, snow, sleet and ice for outdoor installations.

Type SC—TOTALLY ENCLOSED FAN COOLED—protects against dusts, mist or fog detrimental to the vital parts of the motor. The inner frame protecting the motor is sealed to keep out harmful matter.

Type SC—EXPLOSION PROOF protects against atmospheres charged with explosive dusts or gases. They carry Underwriters' label for specific kinds of hazards.



Type SR—SLIP RING- wound rotor motors are suitable for applications requiring low starting current with high starting torque, reversing, or adjustable speed.



Type SY—SYNCHRONOUS MOTORS- suitable for continuous operation at a uniform load for power factor correction.

SINGLE PHASE

Type RS—REPULSION START INDUCTION—single phase brush lifting motor suitable for applications requiring high starting torque with low starting current.

Type CSH—CAPACITOR START INDUCTION—single phase motor suitable when high starting torque with normal starting current is required.

Type SP—SPLIT PHASE, INDUCTION—single phase motors—suitable for light starting duty.

DIRECT CURRENT

Type DN—DIRECT CURRENT MOTORS—suitable for use where direct current is available or its use desirable.

These illustrations are typical of Century's complete line of motors. Others available include gear motors, generators, AC and DC motor generator sets.

Specify the right Century motor for all your electric power requirements.

Popular types of standard ratings are generally available from factory and branch office stocks.

CENTURY ELECTRIC COMPANY

1806 Pine Street
St. Louis 3, Missouri

Century C MOTORS

645

Offices and Stock Rooms in Principal Cities

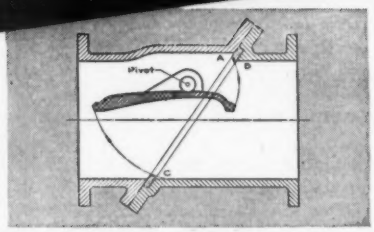
SAVE UP TO 80% IN HEAD LOSSES

with CHAPMAN TILTING-DISC CHECK VALVES

That's right! With Chapman Tilting-Disc Valves, head losses are 65% to 80% lower than for conventional type check valves.

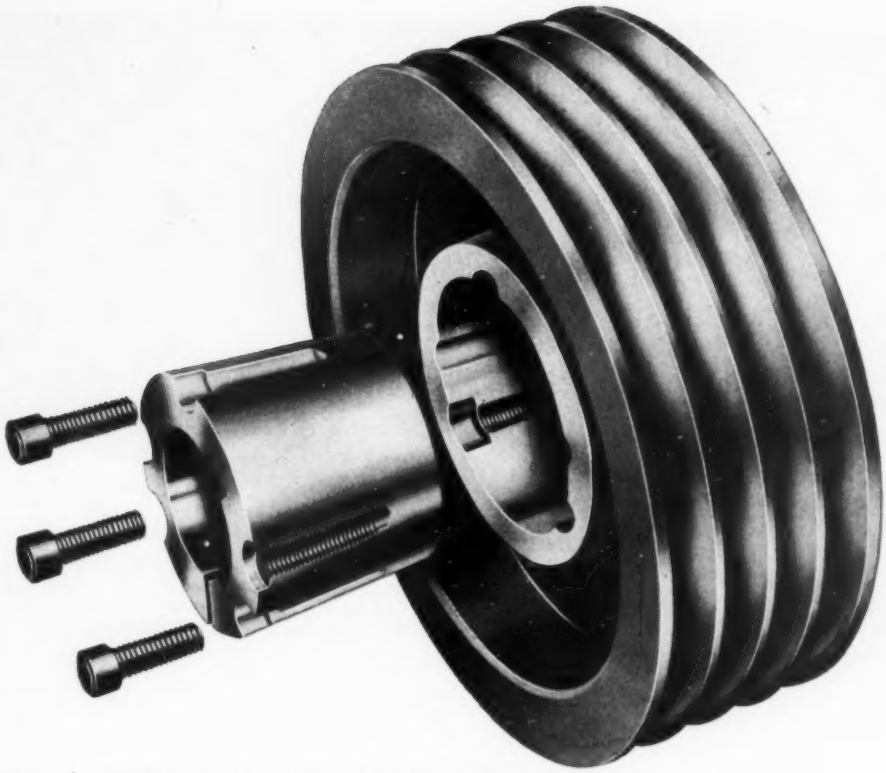
But no wonder head losses are lower. Chapman Check Valves work with . . . not against . . . the stream. The balanced disc rides smoothly on the flow . . . lifts away easily in opening and closes quickly and quietly. There's no slamming to cause destructive pipe line stresses . . . minimum wear on seats, hinge pins and bearings.

All these features mean lower maintenance costs for you. So write *today* for additional information.



Cross-section of the Chapman Tilting Disc Check Valve illustrating the way that the balanced disc is supported on the pivot, with arrows showing the travel of the disc. A feature of the design is that the disc seat lifts away from the body seat when opening, and drops into contact when closing, with no sliding or wearing of the seats.

The Chapman Valve Mfg. Co.
INDIAN ORCHARD, MASSACHUSETTS



The new idea in V-Belt Sheaves
that saves you time and money!
Proved in over 3/4 million installations!

TAPER-LOCK

1 No flange. No collar. It's different.

2 Easy on—easy off.

3 Just tighten the screws that wedge the bushing. Simple, isn't it?

4 Always a perfect fit on shaft—tight as "shrunk-on."

5 Complete range of sizes. A, B, C and D grooves, in stock.

6 Try it—and you'll standardize on it!

DODGE MANUFACTURING CORPORATION • MISHAWAKA, INDIANA

CALL THE TRANSMISSIONEER, your local Dodge Distributor, for information on new and better methods of transmitting power. Look for his name under "Power Transmission Equipment" in your classified telephone book.

DODGE
of Mishawaka, Ind.

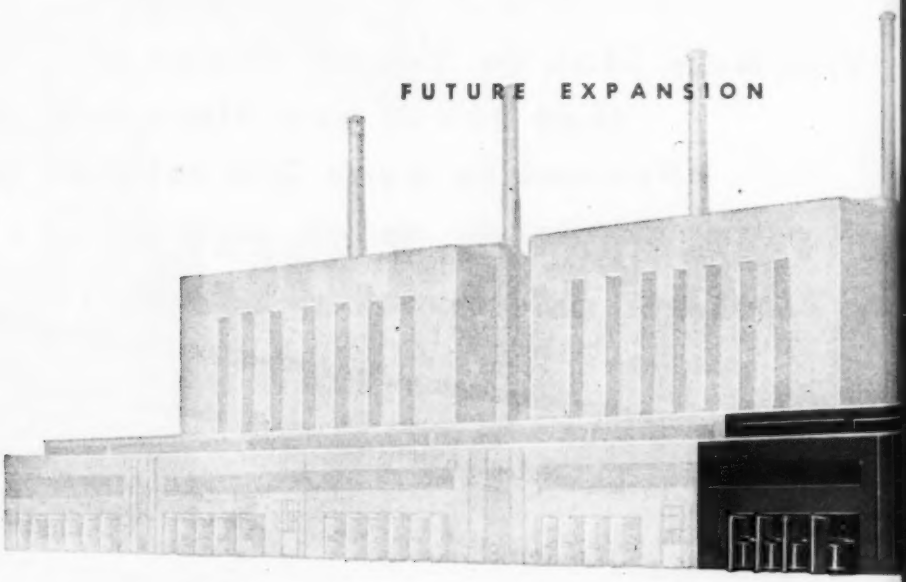
NAME PLATES

FOR YOUR NAME PLATE REQUIREMENTS, WRITE OUR SUBSIDIARY,
ETCHING COMPANY OF AMERICA, 1520 MONTANA STREET, CHICAGO 14, ILLINOIS

SUNBURY

a tradition of leadership

On the evening of July 4th, 1883, Thomas A. Edison placed in operation the first three-wire central station electric lighting plant in the world at Sunbury, Pa. Power was supplied to the old City Hotel three blocks away which was then on the site now occupied by the Hotel Edison.



The world's largest power plant using pulverized anthracite has been completed recently on a site near Shamokin Dam along the Susquehanna River about two miles below Sunbury, Pa. This 150,000 kw installation, first of a number planned for the site, is part of the Pennsylvania Power & Light Company's network serving 28 counties which cover an area of 9,500 sq miles in central eastern Pennsylvania.

The two 75,000 kw turbine generators are served by four 130-ft high Foster Wheeler Steam Generators, the largest ever built for direct firing of pulverized anthracite.

An extension of 100,000 kw capacity, now under construction, will be completed in 1951 and equipped with Foster Wheeler Steam Generators.

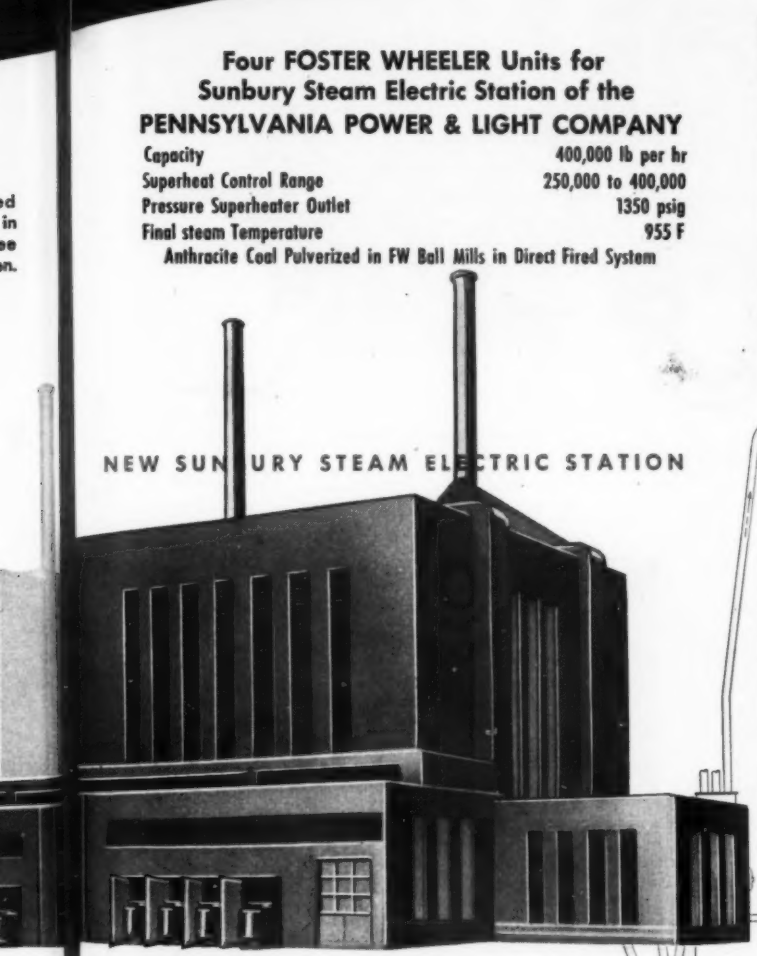
FOSTER WHEELER CORPORATION • 165 BROADWAY

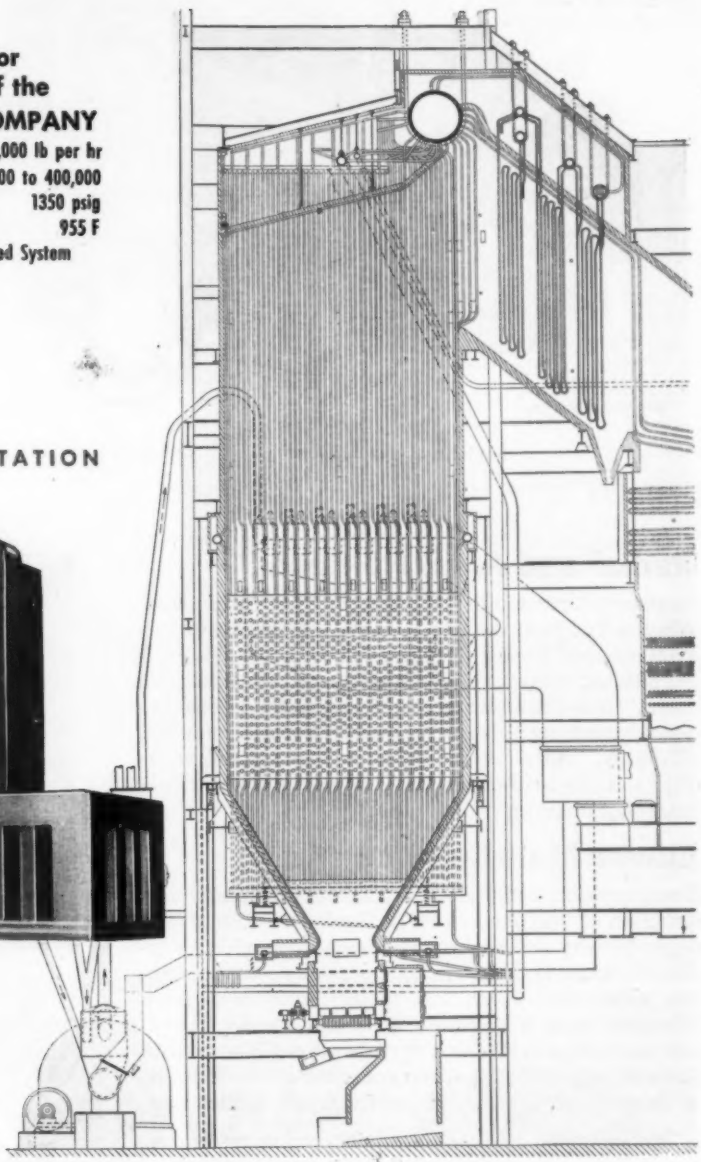
still lights the way

Four FOSTER WHEELER Units for Sunbury Steam Electric Station of the PENNSYLVANIA POWER & LIGHT COMPANY

Capacity	400,000 lb per hr
Superheat Control Range	250,000 to 400,000
Pressure Superheater Outlet	1350 psig
Final steam Temperature	955 F

Anthracite Coal Pulverized in FW Ball Mills in Direct Fired System





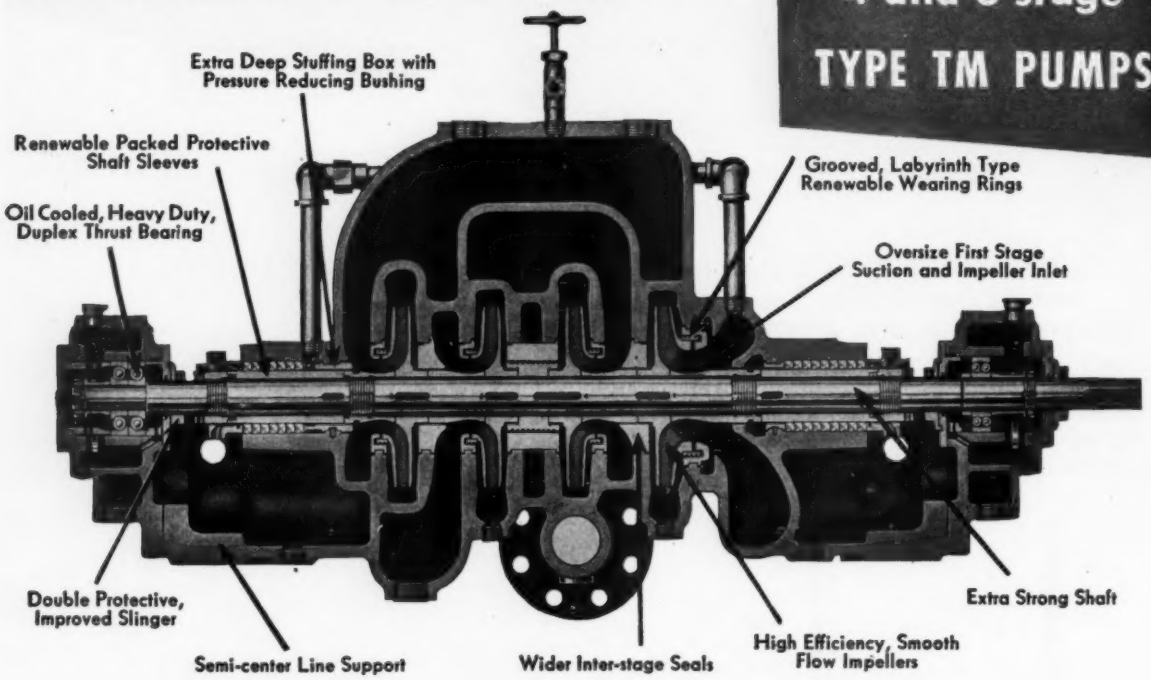
Each steam generator is equipped with two Foster Wheeler ball mill pulverizers which have a combined output of 27 tons of coal per hr.

FOSTER WHEELER

NEW YORK 6, N. Y.

Here's why you get longer life, higher efficiency, greater dependability from

WARREN
4 and 6 stage
TYPE TM PUMPS


Extra Deep Stuffing Box with Pressure Reducing Bushing
Renewable Packed Protective Shaft Sleeves
Oil Cooled, Heavy Duty, Duplex Thrust Bearing
Grooved, Labyrinth Type Renewable Wearing Rings
Oversize First Stage Suction and Impeller Inlet
Double Protective, Improved Slinger
Semi-center Line Support
Wider Inter-stage Seals
High Efficiency, Smooth Flow Impellers
Extra Strong Shaft

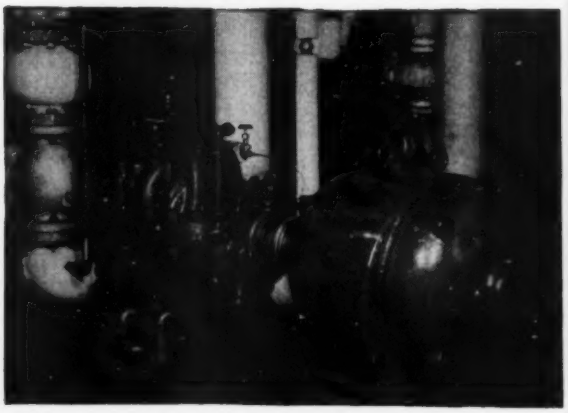
Radial and Axial Balance

Increased dependability, efficiency and life result from Warren TM pumps being in radial balance as well as axial balance. Radial balance is achieved by having half the number of stages discharging up and the other half down, thus eliminating dangerous shaft deflections which cause excessive wear at all close fits, reducing efficiency. Axial thrust is controlled by mounting impellers back-to-back, thus avoiding troublesome balancing drum or thrust plate.

Lower Maintenance

Every possible care has been taken in design and construction of Warren Type TM Pump to insure utmost dependability and highest efficiency through elimination of danger of failure and reduction of wear to absolute minimum. Thus low maintenance is assured. Wherever wear is inevitable after long service, renewable parts are provided and all parts are easily accessible. Horizontally split case allows complete access to rotor, or its removal, without disturbing main connections.

Send for bulletin #241 . . . . . or better, send an outline of your pumping problem and get a Warren recommendation.



Heywood-Wakefield Company, Gardner, Mass., manufacturers of quality furniture since 1826. Illustrated is a recent installation of Warren Type TM-Four Stage Pump in their modern, efficient boiler plant.

P-15A

Warren Steam Pump Company, Inc.
WARREN, MASSACHUSETTS

WARREN PUMPS

The Aerotec Family

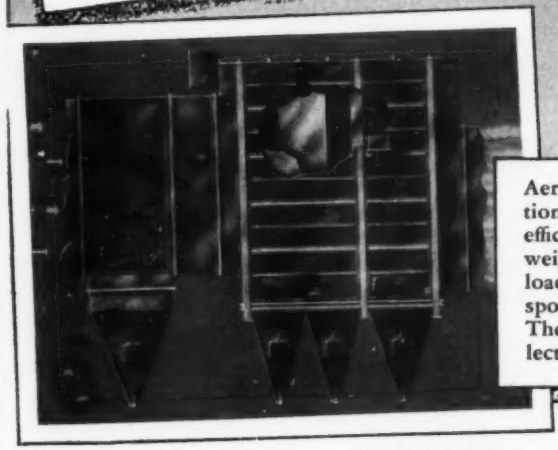
OF DUST COLLECTORS

Aerotec **MECHANICAL, DESIGN #3 RAS**... a collector that offers the last word in fly ash control by mechanical methods. Constructed of standard unit building blocks, consisting of small diameter, permanent mold cast aluminum tubes; this offers the advantages of mass production methods with the flexibility of a tailor made installation.

Because of the small diameter tubes (3"), exceptionally high efficiency is obtained even on extremely fine pulverized fuel. Installed alone, it fits readily into your design, and the horizontal multi-tube outlet provides the perfect inlet for the ...

Aerotec **ELECTRICAL PRECIPITATOR**... offered as a secondary to the mechanical, or as a complete collector in itself.

The Aerotec electrical dust collector applies an entirely new concept to this art of precipitation, provides maximum charging and precipitation, and by use of the new pocket design, insures a dead zone surrounding the collecting electrode, thus preventing reentrainment of dusts. A combination of these two units is now available as the ...



Aerotec **SERIES COLLECTOR**... highest in collection efficiency on all types of dusts. A guaranteed efficiency of 97½% on most dusts; minimum weight and space per c.f.m.; a flat efficiency vs. load response and in addition, the undivided responsibility from drawing board to installation. These advantages all assure the finest in dust collection available.

Canadian Affiliate:
T. C. CHOWN, LTD., 1440 St. Catherine St. W., Montreal 25, Quebec

THE THERMIX CORPORATION

PROJECT & SALES ENGINEERS

GREENWICH, CONN.

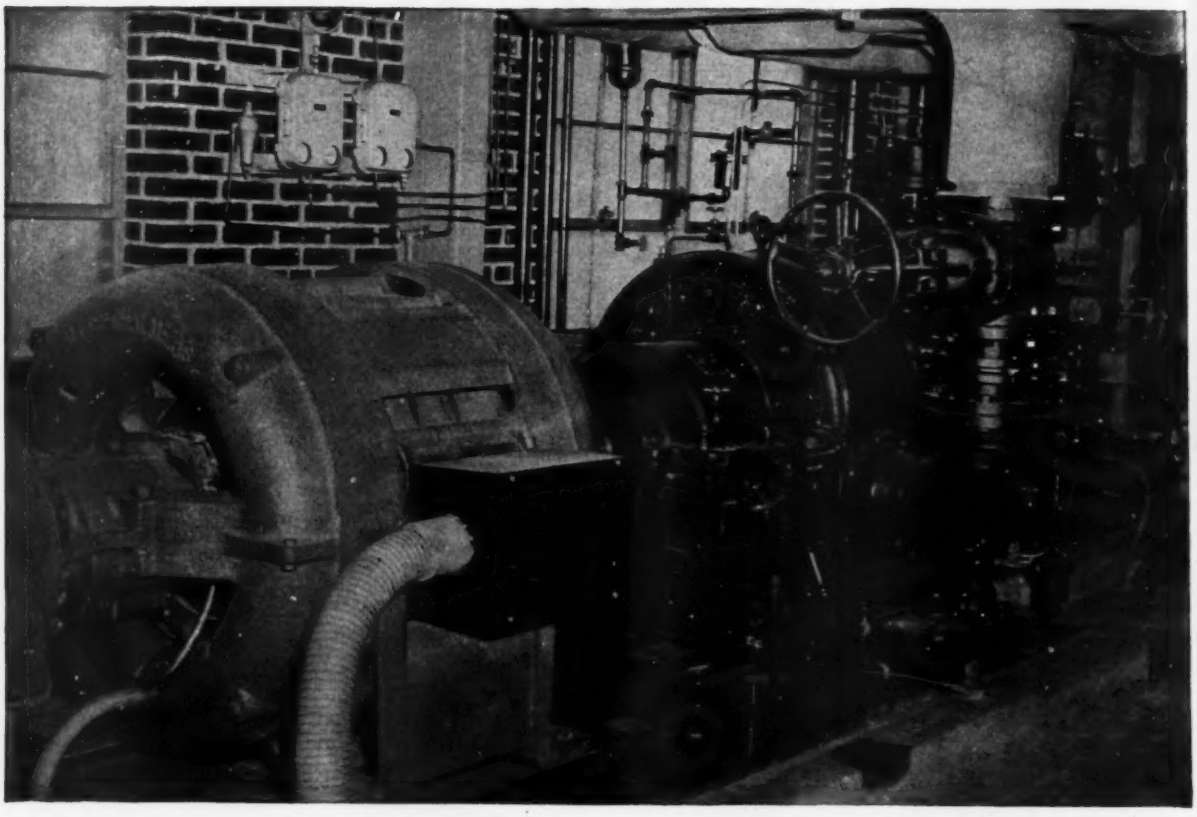
(Offices in 28 principal cities)

AEROTEC

THE AEROTEC CORPORATION

GREENWICH, CONNECTICUT

The TERRY TURBINE



For By-Product Power and Steam Balance

This 200 kw Terry Turbine driven generating unit operates in parallel with other generating equipment, the load on the unit being adjusted in accordance with the demands for exhaust steam. It is a single stage axial-flow, type, 4500/1200 rpm, 160 psi, 0 superheat, 5 psi back pressure, equipped with Terry reduction gears, oil-relay governor, motor synchronizer and back-pressure regulator.

The installation pictured above is typical of many special applications of Terry Steam Turbines, each designed for specific requirements.

Any of our district representatives will gladly give you full information on a turbine to meet your requirements, no matter how special they may be.

No obligation, of course.

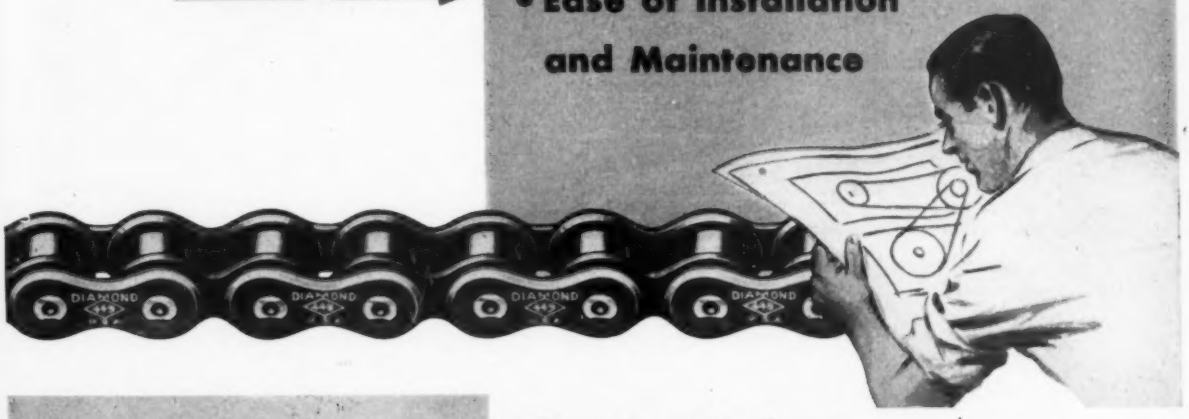
T-1176

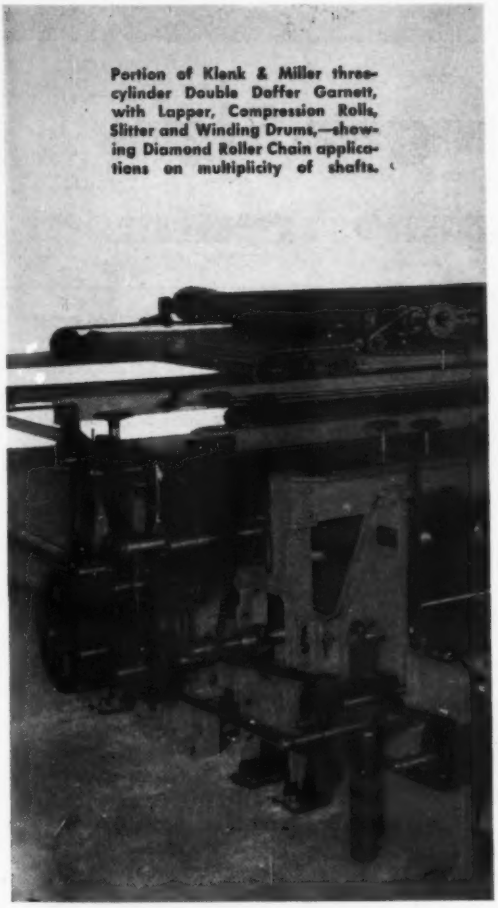
THE TERRY STEAM TURBINE COMPANY
TERRY SQUARE, HARTFORD, CONN.

For *Compactness* In Machine Design Use Diamond Roller Chain Drives

Gain These Added Advantages →

- **Positive Operation - no slip**
- **Wide Choice in Shaft Locations**
- **Ease of Installation and Maintenance**





Portion of Klenk & Miller three-cylinder Double Doffer Garnett, with Lapper, Compression Rolls, Slitter and Winding Drums,—showing Diamond Roller Chain applications on multiplicity of shafts.

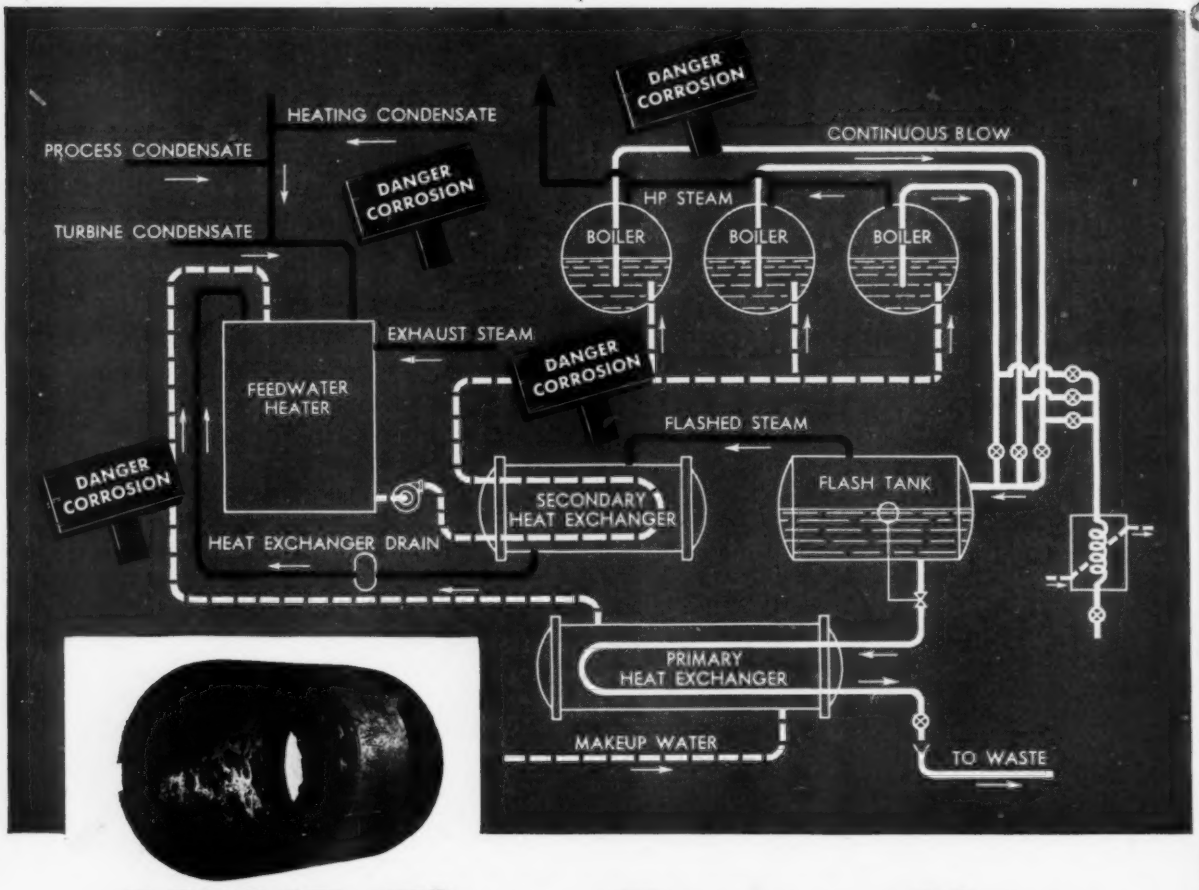
There is practically no limit to Diamond Roller Chain applications. Those responsible for machinery and equipment development find more and more ways to improve design and simplify manufacture while assuring better performance through the use of Diamond Chains.

Because center distances present no problem, shafts may be located where most logical from manufacturing and operation standpoint.

There is no slipping regardless of speed, load or distance between shafts. Friction is not a factor—therefore speed ratios are maintained and bearing pressures minimized. A handy guide to chain selection,—new Catalog 649 will be mailed on request.

DIAMOND CHAIN COMPANY, Inc., Dept. 412, 402 Kentucky Avenue, Indianapolis 7, Indiana. *Offices and Distributors in All Principal Cities.*

DIAMOND ROLLER CHAINS



AVOID These Danger Signs with BIRD-ARCHER Amine Treatment

CORRODED condensate return lines lead to expensive pipe replacement and maintenance. As an added annoyance, the solid products of corrosion often plug return lines and fill traps. You can steer clear of these troubles by using the *effective, economical* Bird-Archer Amine Treatment.

HERE'S THE WAY THIS B-A TREATMENT WORKS

Amines are fed into the boiler or into the steam and condensate systems. The amines raise the pH value of the condensate and also tend to inhibit equipment-destroying corrosion through surface protection of the metal itself.

HERE'S HOW THIS B-A TREATMENT SAVES MONEY

Raising the pH value of the condensate severely decreases maintenance costs by eliminating corrosion. These savings may more than offset the amount of treatment required to provide protection for your equipment.

NEW BULLETIN gives full details on the Bird-Archer Amine Treatment. . . . contains case histories that prove its successful application in many plants. *Write for your copy today.*

BA-154

WHAT AMINES ARE

Amines are members of a class of chemical compounds in which one or more hydrogen atoms of the ammonia molecule are substituted by an organic group. Some of the simpler types are soluble and volatilize from boiler waters. The alkalinity of the amines is an inherent property and does not result from decomposition. *No free ammonia is released.* In the concentrations necessary for protection of condensate systems, amines are harmless to non-ferrous metals, non-toxic and are completely stable at temperatures approximating 675F.

BIRD·ARCHER
WATER TREATMENT

LABORATORIES ENGINEERS CHEMISTS

THE BIRD-ARCHER COMPANY, 400 MADISON AVE., NEW YORK 17, N. Y.
Philadelphia, Pennsylvania • Chicago, Illinois • Montreal, Canada
CALDERAS Y ACCESORIOS, S. A. AMSTERDAM 291, MEXICO, D. F.

"EVERY WORKING DAY OF HEAT LOSS *ANYWHERE* IN YOUR PLANT IS WORKING CAPITAL LOST"

- ONLY ONE COAT NEEDED!
- EXTREMELY HIGH ADHESION!
- ADHERES TO BLOCKS, BLANKETS AND CEMENTS!

B-H POWERHOUSE CEMENT... the new finishing cement that insulates

EASY TO APPLY EVEN OVERHEAD

- HIGH INSULATING EFFICIENCY!
- EASY WORKABILITY REDUCES LABOR!
- LINEAL SHRINKAGE UNDER 1%!
- SMOOTH, HARD SURFACE!
- EFFECTIVE UP TO 1700°

B-H POWERHOUSE CEMENT saves time, cuts costs—a one-coat application trowelled to required thickness in a single operation. Moreover, this new mineral-wool-base finishing cement takes a hydraulic set within two hours.

Its smooth hard finish is paintable. An attractive inside finish can be obtained with any paint. Outside, B-H Weatherseal gives permanent protection.

Easy on labor, easy on budget, B-H Powerhouse is the ideal *finishing-insulating* cement for industrial equipment. For full information and free sample, fill out the coupon.

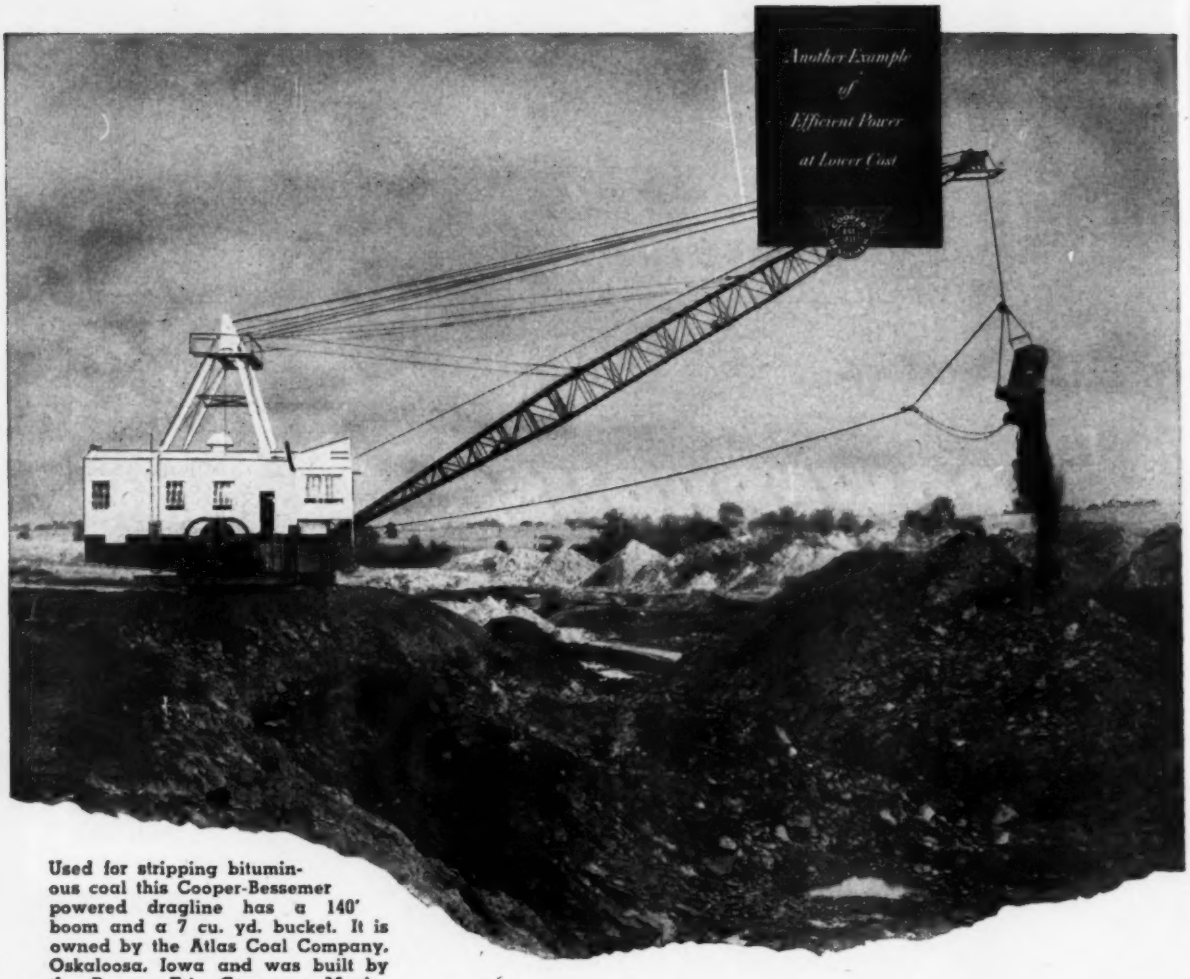
Baldwin-Hill Company
831 Breunig Avenue
Trenton 2, N. J.

Please send me complete information on B-H Powerhouse Cement.

NAME_____ POSITION_____

FIRM_____

ADDRESS_____



Used for stripping bituminous coal this Cooper-Bessemer powered dragline has a 140' boom and a 7 cu. yd. bucket. It is owned by the Atlas Coal Company, Oskaloosa, Iowa and was built by the Bucyrus-Erie Company, Monighan Division.

Proving ground for *Diesel Stamina*

If it's come-what-may reliability and long life you want in your diesel engines, a page from the book on dragline service will give you a good steer. You'd be hard put to find a service that demands more of diesels in the way of flexibility, response and downright toughness.

Because Cooper-Bessemer diesels have these qualities in extra measure, they're widely used today in dragline service. The hard-working, Cooper-Bessemer-powered unit above is typical.

But when you get right down to it, aren't the same qualities just as sure to pay off in any other kind of power service . . . marine, stationary, locomotive or what have you?

Name your heavy-duty power application. You'll find there's a Cooper-Bessemer of the right size and type for the job — one that will hold down your power costs . . . and *keep* them down!

The
Cooper-Bessemer
Corporation
MOUNT VERNON, OHIO — GROVE CITY, PENNA.

New York City Washington, D. C. Bradford, Pa. Parkersburg, W. Va. San Francisco, Calif. Houston, Dallas, Greggton, Pampa and Odessa, Texas Seattle, Wash. Tulsa, Okla. Shreveport, La. St. Louis, Mo. Los. Angeles, Calif. Caracas, Venezuela Gloucester, Mass. Colmes Engineering Co., New Orleans, La.

Flat Work Ironers HOT ENOUGH FOR ASBESTOS COVERS

...thanks to Yarways

American Linen Supply Co., in Seattle, Wash., operates one of the most modern laundries in the Northwest. Throughout the plant they use Yarway Impulse Steam Traps—nearly 200 of them!

Yarways contribute much toward efficient, speedy operation of equipment. *They get it hotter, sooner and keep it hot!* For instance, the flat work ironers illustrated above are kept so hot by Yarway Traps that they use asbestos covers instead of the usual cotton cloth.

Other Yarway features: small size for easy installation; minimum maintenance (a small valve is the only moving part); dependable operation; low cost; good for all pressures. More than 600,000 Yarways have already been bought.

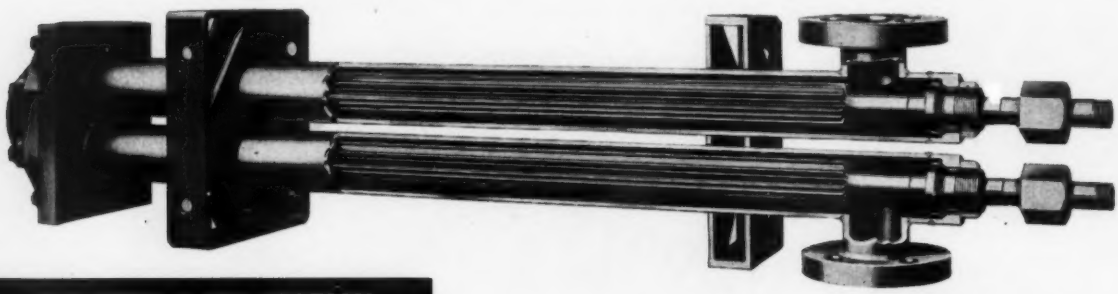
Try a Yarway Impulse Trap with a Yarway Fine Screen Strainer on any piece of equipment for a test. See if temperatures aren't higher . . . and production costs lower. Over 170 distributors sell Yarway Traps. For name of the one nearest you and free Trap Book, write

YARNALL-WARING COMPANY 109 Mermaid Avenue, Philadelphia 18, Pa.

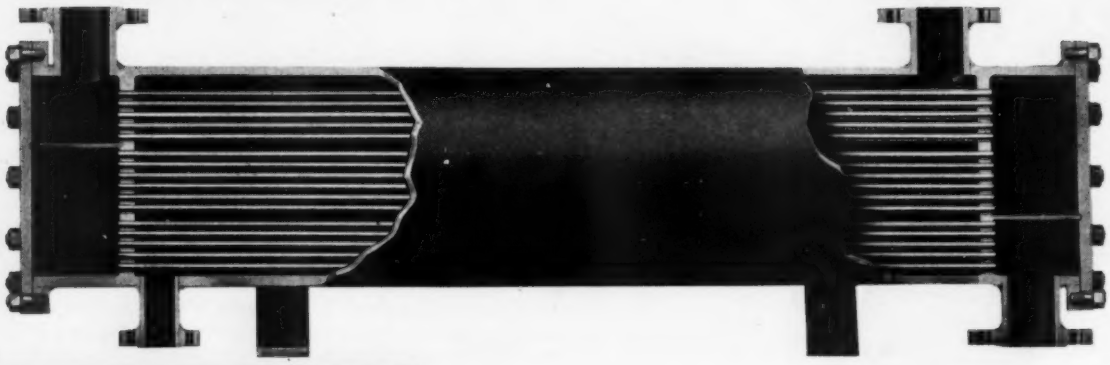
Branch Offices in Principal Cities

YARWAY **IMPULSE STEAM TRAP**

Take Your Choice for
FUEL OIL HEATING



G-R TWIN G-FIN SECTION



G-R TYPE B TUBULAR HEATER

G-R offers you the choice of two different designs of fuel oil heater. Both designs are of long-proven heating effectiveness and dependability. Both designs have readily accessible tube interiors and are easy to keep clean. Both designs are of sturdy construction and are lastingly secure against leakage.

If your requirements are for the heating of large quantities of oil, you want the compact, easily handled G-R Type B Heater.

Where your requirements are for moderate or small quantities, with great capacity flexibility and a minimum of spare equipment, you want the G-R Twin G-Fin Section.

Write for full information on each of these units, and for advice as to the most suitable type of heater for your particular plant conditions.

THE GRISCOM-RUSSELL CO., 285 MADISON AVENUE, NEW YORK 17, N. Y.

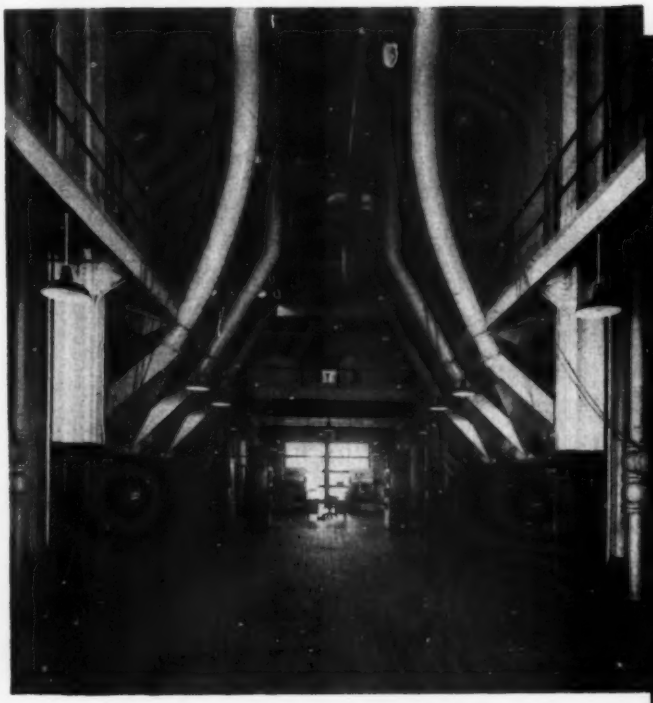
GR-227

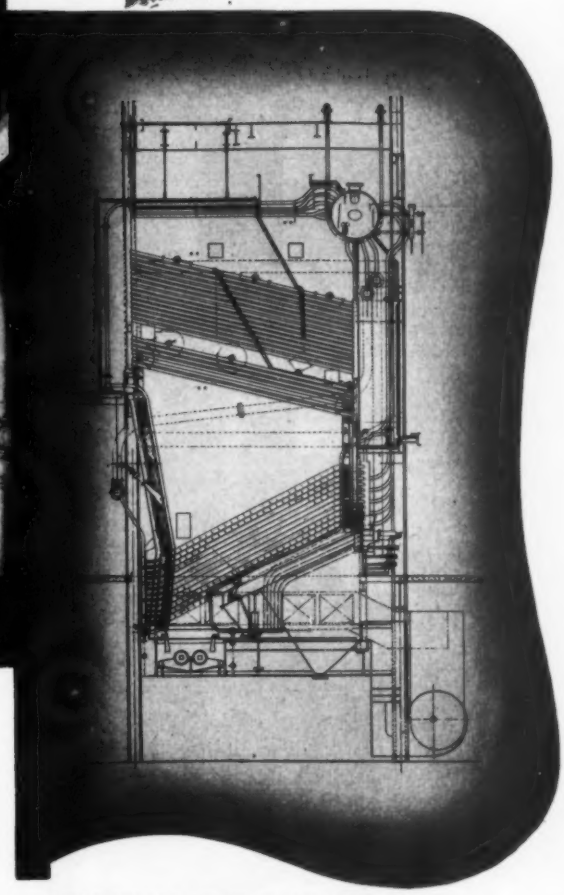
GRISCOM-RUSSELL

PIONEERS IN HEAT TRANSFER APPARATUS

Federal Works Agency Photos

More Heat for the NATION'S CAPITAL





New $8,000,000
WEST HEATING PLANT
Washington, D. C.

Served By

Vogt FORGED STEEL SECTIONAL HEADER STEAM GENERATORS

ADDITIONAL ORDER NOW BEING FABRICATED FOR THIS PLANT

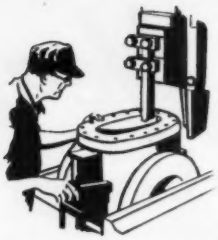
•

Principal Data, Each Unit

220,000 pounds steam per hour capacity
Steam and water drum is fusion welded and designed for 400 pounds S.W.P.
Sinuous forged steel tube headers. Water cooled furnace walls.

HENRY VOGT MACHINE CO.
Louisville 10, Kentucky

BRANCH OFFICES:
New York • Philadelphia • Cleveland
Chicago • St. Louis • Dallas



A DISTINCTIVE FEATURE IN DISC GUIDING

Body guides are machined down to precision tolerances, assuring a perfect guide for the disc and creating a positive center line on which all subsequent machining operations are based.

BODY PRECISION MACHINED TO INSURE PERFECT FIT OF SEAT RINGS

This operation makes inserting the seat rings in a Lunkenheimer gate valve simply a matter of screwing them into position. Parts can be replaced without any machine work or special fitting.

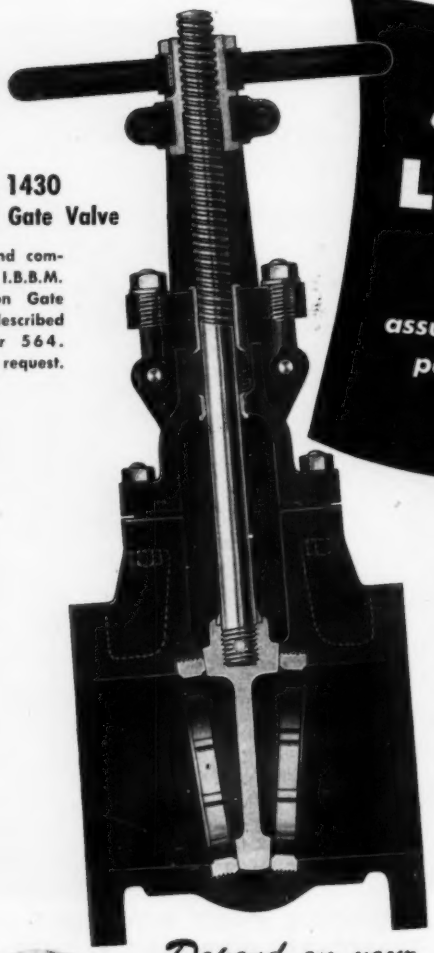


Fig. 1430
Iron Body Gate Valve

Fig. 1430 and complete line of I.B.B.M. and All Iron Gate Valves are described in Circular 564. Mailed upon request.

Precision Made LUNKENHEIMER VALVES....

assure perfect-fitting, interchangeable parts . . . longer valve life . . . easier, lower-cost maintenance!

THE smooth working efficiency and low maintenance cost of Lunkenheimer Valves were not "made in a day." Behind this superior performance and economy lies long experience, top engineering and metallurgical facilities together with the most modern manufacturing equipment.

Lunkenheimer Valves have a streamlined simplicity of design . . . a minimum of working parts, each part of extra strength, correctly proportioned and perfectly balanced. This assures longer life with lower maintenance expense.

Depend on your* LUNKENHEIMER DISTRIBUTOR *for service and reduced valve inventory!

Many concerns, large and small, have found real savings by depending on the complete stocks of Lunkenheimer Distributors. Capital formerly tied up in slow-moving inventory is available for other uses; losses from obsolescence are eliminated or drastically reduced. Ask your Distributor how he can help you.

ESTABLISHED 1862

THE LUNKENHEIMER CO.

"QUALITY"

CINCINNATI 14, OHIO, U.S.A.

NEW YORK 13 • CHICAGO 6 • BOSTON 10 • PHILADELPHIA 34

EXPORT DEPT. CINCINNATI 14, OHIO, U.S.A.

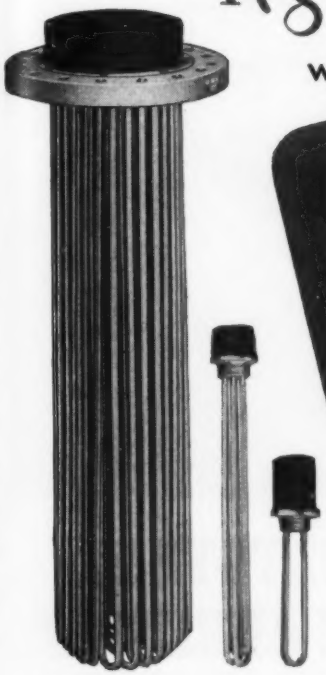
HEAT GASES AND LIQUIDS

Efficiently and Economically

"*Right on the Job!*"

with

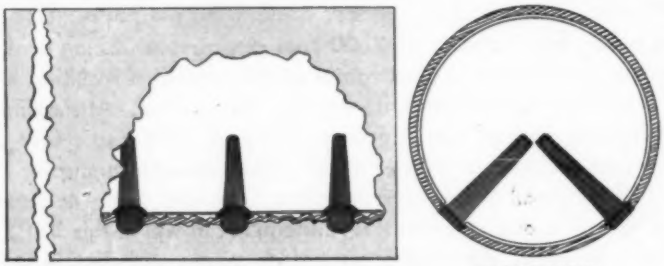
CHROMALOX
Electric
IMMERSION HEATERS



TMO Type Immersion Heaters are made in sizes up to 75 KW to operate in temperatures up to 800° F. and pressures up to 600 pounds.

CHROMALOX Tubular Immersion Heaters are used for heating compressed air and other gases: for super-heating steam; for heating liquids and Dowtherm, Prestone and similar heat-transfer mediums. They can be readily applied to high-temperature and high-pressure operations.

CHROMALOX Electric Immersion Heaters give you the *exact* temperatures you require and maintain these temperatures accurately. Dependable performance, economical operation, reduced spoilage are among other advantages gained by using these easy-to-install heaters.



SIDE VIEW FRONT VIEW

GIANT STEAM ACCUMULATOR USING CHROMALOX IMMERSION HEATERS (SIMPLIFIED VIEW)

Twenty-four TMO Heaters of 24 KW each are used in this steam accumulator (approximately 72 feet long, 8 feet diameter) to maintain 300° F steam temperature.

This installation was worked out on the job by Chromalox Application Engineers who are always ready to help solve your heating problems.

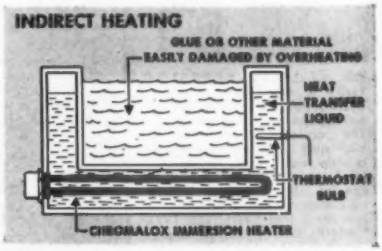
CHROMALOX

Electric Heat for Modern Industry

EDWIN L. WIEGAND CO. · 7520 Thomas Boulevard · Pittsburgh 8, Pa.

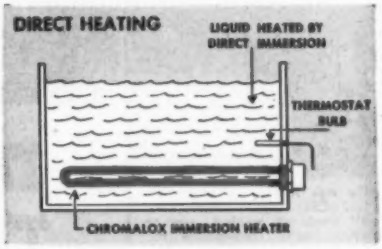
Typical Examples

of a few of the many uses for Chromalox Immersion Heaters



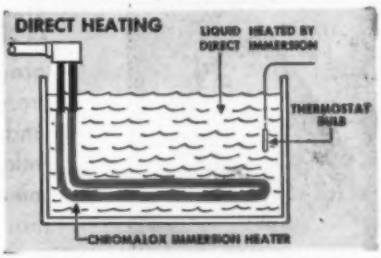
WATER OR OIL JACKETED KETTLES

Heaters are quickly and easily mounted in kettle wall; temperatures are accurately maintained manually or by automatic control. Uniform heat transfer makes this application particularly good for liquids that must be heated slowly to prevent damage by overheating.



HEATER MOUNTED PERMANENTLY IN TANK

Chromalox Immersion Heaters are welded or bolted through tank wall. Heaters are sheathed in copper, steel or alloy—as required to defeat corrosion. Temperatures are controlled thermostatically. Heat is absorbed directly and efficiently.



FOR HEAVY-DUTY IMMERSION HEATING

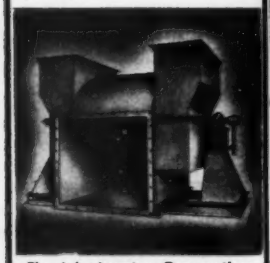
Low-density Immersion Heaters are especially designed for high-temperature melting-pots or salt baths. Heaters have legs to raise elements above sludge accumulation. They are quickly installed and easily removed for maintenance.

Want more Examples?

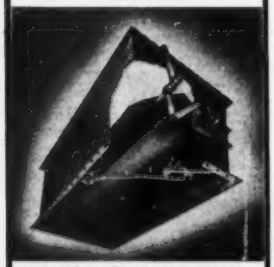
Request the fully-illustrated booklet "100 Ways to Apply Electric Heat." It contains photographs and drawings showing Chromalox Electric Heaters at work in plants throughout the United States. Write today for your copy.

IC-41

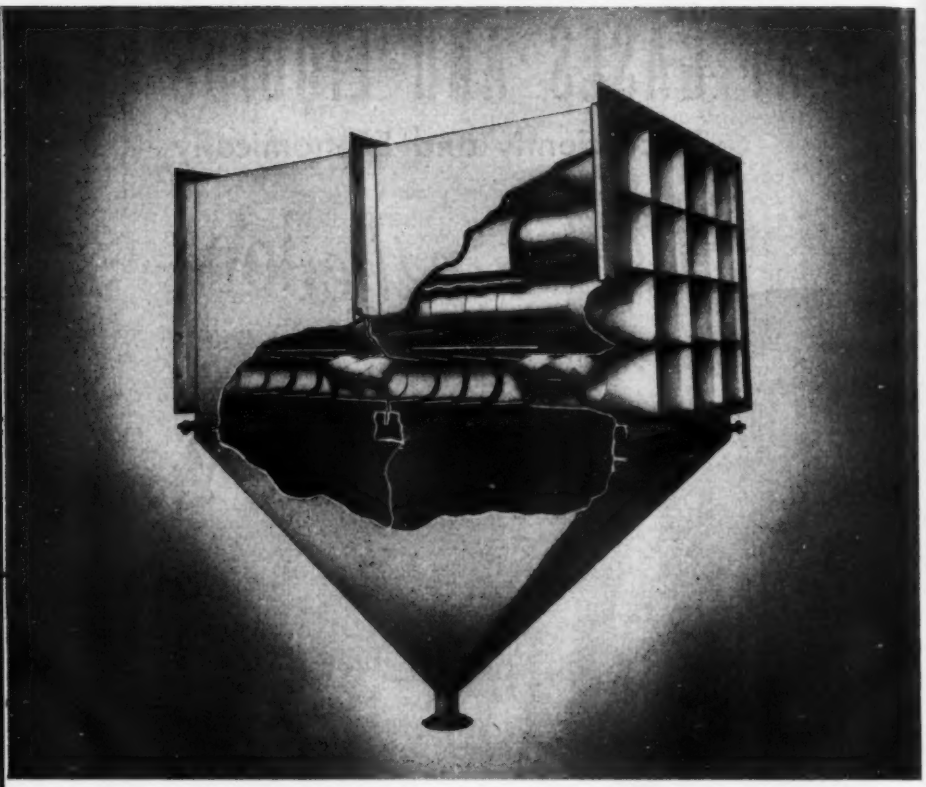
The CELLULAR ARRESTOR (left) is especially suited to applications where longitudinal space is at a premium. The collection efficiency is high and is fairly uniform over a wide load range. Tubes may be furnished in cast iron or in special alloys. Where highest efficiency is not required, the low draft loss CHIMNEY TYPE "WHIRLEX" (right) is recommended. Installations can be made in steel, brick, or concrete chimneys. Special seals and hangers are provided to prevent any damage from expansion.



Fly Ash Arrestor Corporation INDUCED DRAFT FANS are all steel, all welded, and of extra heavy construction for dependable service under severe operating conditions. Sizes are available for any capacity. Although standard as to general design, these fans are custom built to the requirements of each installation. Water cooled shafts allow the use of standard ball and roller bearings.



CONTROLLED RATIO DAMPERS are especially designed for use with combustion control equipment, and feature twin streamlined coordinated damper leaves. Heavy steel spindles are supported by self-aligning flanged ball bearing units. The damper leaves are balanced to provide a damper of low operating effort to insure trouble free operation.



THE "WHIRLEX" MULTI-TUBE TRUN-CONE FLY ASH ARRESTOR

The HIGHLY EFFICIENT truncated cone type fly ash collector element, from which the two stage collector pictured above was assembled, consists of a triple flight, oblique, helicoid followed by a series of truncated cones. The leading edges of the cones are chamfered and the units are mounted to provide efficient escapement clearances around the periphery. Designs are based on a full load velocity of 2500 feet per minute. Since erosion from gas-borne solids is not a serious factor at this speed, a resulting long and MAINTENANCE-FREE arrestor life can be anticipated. At maximum velocity each tubular element has a gas capacity of 1194 cubic feet per minute with a water gauge draft loss of 1.65". Each element occupies 12" (horizontal) x 11" (vertical) cross-sectional area. The two stage horizontal arrestor shown above is one of several arrangements in which this VERSATILE element can be used. Arrangements include single and double stage arrestors for horizontal, inclined, and vertical runs of breeching, as well as special package units assembled complete with induced draft fan, stub stack, and support structure.

For more complete information, write for general catalogue.

THE FLY ASH ARRESTOR CORPORATION

BIRMINGHAM ALABAMA

P.O. Box 1883 Phone 54-6676

INDUSTRIAL POWER

January, 1950 Vol. 58, No. 1

SELL BASIC ECONOMIC FACTS!!!

THOMAS ROY JONES,
President, ATF Incorporated

THE great appeal of the socialist or the communist to the people is that he is doing something about the common man upon whom he alleges industry is trampling in a greedy rush for profits. This is, of course, a rank misrepresentation. Only through the service rendered by American industry and business over the past 150 years has the American man become the best paid, best educated, and healthiest in all of the world. To combat these misrepresentations, business leaders must have a thorough knowledge of basic economic facts and know how to sell them. In presenting our case, we cannot afford to take the attitude of "Let George do it" or leave the job entirely to our national trade or business groups.

Musts

Business must recognize the situation we are facing, fit its action to conditions, and abandon the temporizing attitude which expresses the faith that our cause is right and that time will bring all things right in the end. What we can do to offset what is being done by our enemies falls into three categories: what we can do as a business, what we can do through our organizations, and what we can do as individual citizens.

Business must get closer to employes, find out what they are thinking, and get to them the facts and all the facts about our own business and business generally. And we must tell them those facts in a way in which they will not only understand but will agree with them.

Business must be a part of the community through participation in the work of the community, cooperation with the schools on constructive programs, and similar activities.

Through organizations equipped to do the job, we can carry on basic research in economics and sociology. Such organizations should give out unbiased information, in language and in method, so that those with relatively small knowledge of economics can readily grasp the facts.

As citizens we must learn the facts so that we may be armed mentally to defend our country. Then we can teach those facts to others. We can enter politics. We can get others in our own group stirred up to do the job that needs to be done and we can become active in local forces.

Whatever we do must be *for* something. If the socialist or communist points out a sore on the skin of society, we as businessmen should have ready a positive, constructive, reasonable remedy which does not involve reliance on Washington.

If we are to preserve our system, we need to study the enemy's strategy, techniques, and weapons. The battle is one of human ideas and ideals of human rights. It is one of fact and truth against lies, half-truths, and distortions. The battlefield is that of the human mind—the mass psychology of the American people and the peoples of the world.

Weapons

The strategy and techniques are those of selling and the weapons are ideas, arguments, truth and facts, and the explosives which drive them home are words —words forcefully and effectively spoken and forcefully and effectively written.

Who is better fitted to carry on a selling job than the industrialist or the businessman? Have we not been selling things for centuries? But now we must learn to sell the intangible products of the human mind, ideas and ideals, as well as the tangible, the physical products of human hands or of machines controlled by those hands. We know this can be done because some companies and executives are doing it.

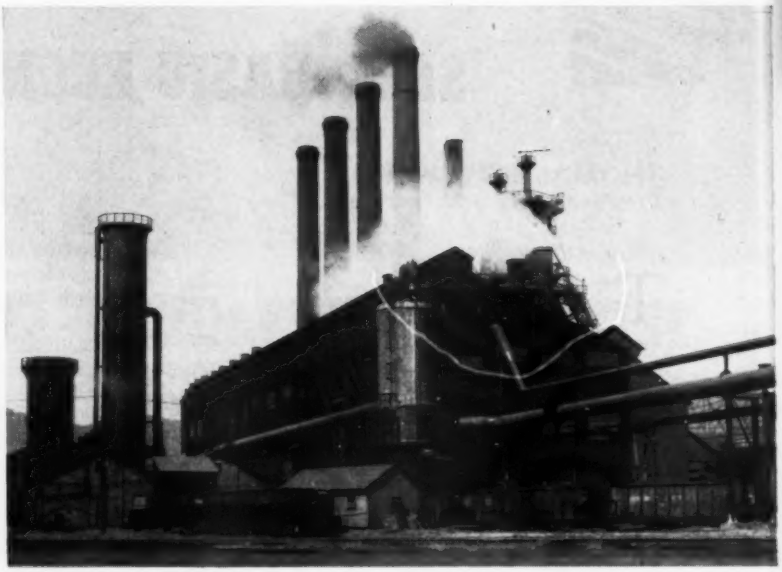
CRUCIBLE'S NEW BOILERS OPERATE EFFICIENTLY AT 113% OF RATING

Although designed for 75,000 lb of steam per hour two new integral-furnace boilers at Crucible Steel Company of America's Midland, Pa. plant have produced 85,000 lb of steam per hour around the clock with no ill-effects. Pulverized coal burners are also equipped to burn blast furnace gas. Surplus navy deaerating heater was purchased and converted to stationary service.

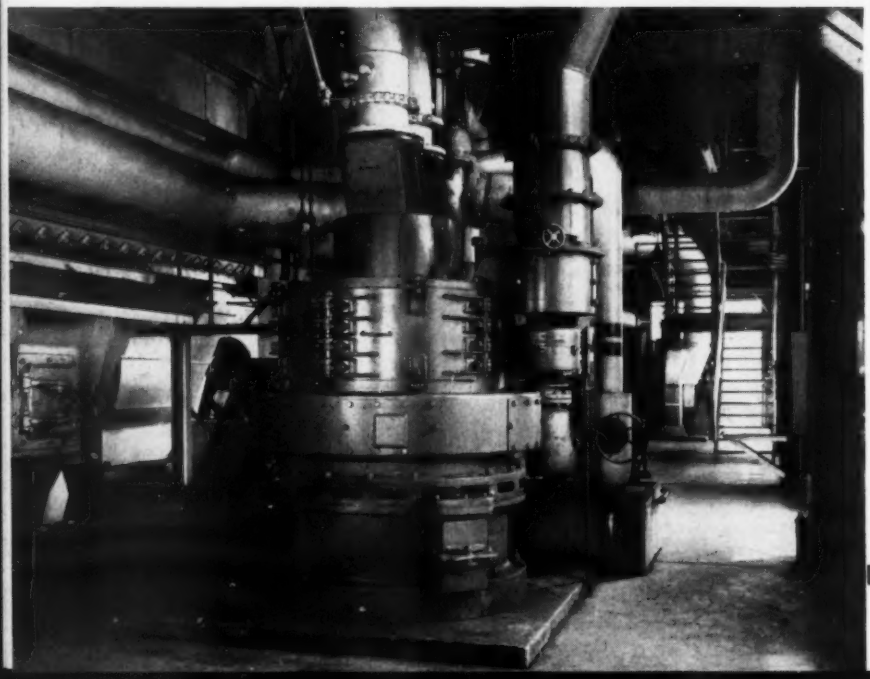
C. H. LEATHAM, JR., Project Manager, The Rust Engineering Company

EARLY last year two pulverized coal-fired boilers of 75,000 lb of steam per hour continuous capacity were placed on the line in the No. 3 blast furnace boiler house of the Crucible Steel Company of America at Midland, Pennsylvania. Since, the two units have repeatedly produced 85,000 lb per hour for periods of 24 hours with no apparent ill-effects. Although accurate means of weighing the coal burned are not available, examination of steam flow-air flow and gas temperature charts indicate that boiler efficiencies equal or exceed the guaranteed 85.4% when operating at 75,000 lb per hour.

Another interesting feature of the installation is that the boilers were also designed for future operation on surplus blast furnace gas. Pulverized coal burners are equipped with annular rings for the burning of the waste gas, and the air preheaters are arranged to utilize blast furnace gas as well as boiler flue gas.



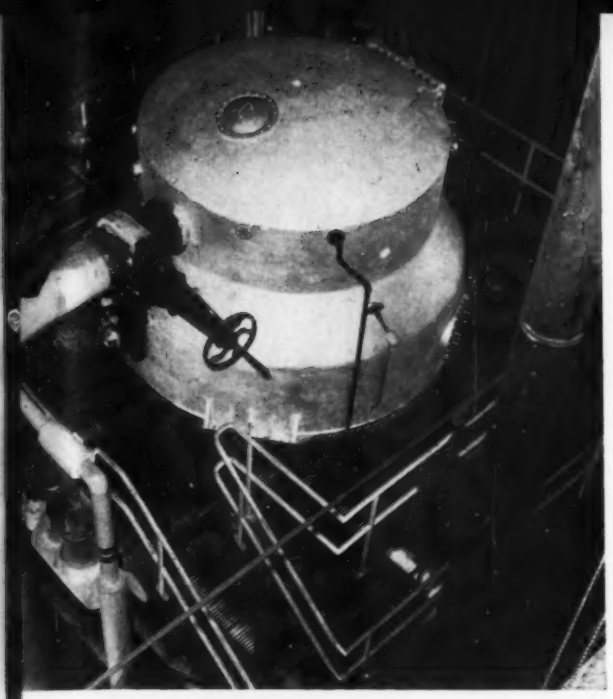
Enlarged boiler house for No. 3 blast furnace before construction shanty and materials in foreground were removed. New boilers are adjacent to exposed crane columns.



Pulverizers for new boilers are located on the ground floor. Ash hopper for one of the boilers is shown at left.

Steam generators are of the integral-furnace type complete with water-cooled walls. Heating surface of each boiler proper is 8,651 sq ft, plus 2,087 sq ft in the water walls. Design pressure is 250 psi, with an operating pressure at the superheated outlet of 175 psi at 465° final steam temperature.

Each boiler is served by one vertical type pulverizer. Pulverizers are driven by turbines while coal feeders are motor driven.



Top view of marine type deaerating heater. Booster pumps, boiler feedwater pumps, and chemical feed pumps are installed at lower level directly below this unit.

Forced draft fans are single inlet with a capacity of 140,000 lb of air per hour (33,400 cfm) at a static pressure of 9.4 in. of water. They are equipped with an outlet damper and are driven at a maximum speed of 1450 rpm by a direct connected turbine.

When coal is burned flue gases leave the boiler through the lower of two dampered outlets, pass upward through the air preheater, and then downward to the induced draft fan. When burning gases the lower damper is closed and flue gases then go directly from the boiler to the top of the air heater and travel downward through both sides of the heater in a single pass.

Induced draft fans are double width, double inlet with individual capacities of 159,000 lb per hour (59,000 cfm) at 8.3 inches of water and 425° F. They are equipped with outlet dampers of the louvre type and are driven by geared type turbines at a top speed of 635 rpm—an unusually low speed. These fans are of heavy construction and have renewable liners.

Feedwater

Originally, plans were made to supply feedwater to the new boilers by extending the present feedwater system and piping the exhaust steam from the new auxiliaries back to the present feedwater heaters. However, a surplus navy feedwater heater was purchased for less than the cost of additional piping required for extension of the present system. Consequently, the decision was made to install a separate feedwater system for the new boilers.

The spray type deaerating heater has a capacity of 400,000 lb per hour of feedwater with an oxygen content of not over .03 cc per liter (a maximum of 800,000 pounds per hour could be passed through the heater without guarantee of oxygen content). The unit is constructed of a copper-nickel alloy, and arrived at the site with fittings and connections arranged for marine service. An overflow connection was cut in the shell, level and pressure controls were added, and other modifications made to permit adaption of the heater to stationary service. Changes to the heater were complicated by the type of material used in the construction of the heater, and by the lack of complete shop drawings.

Pumps

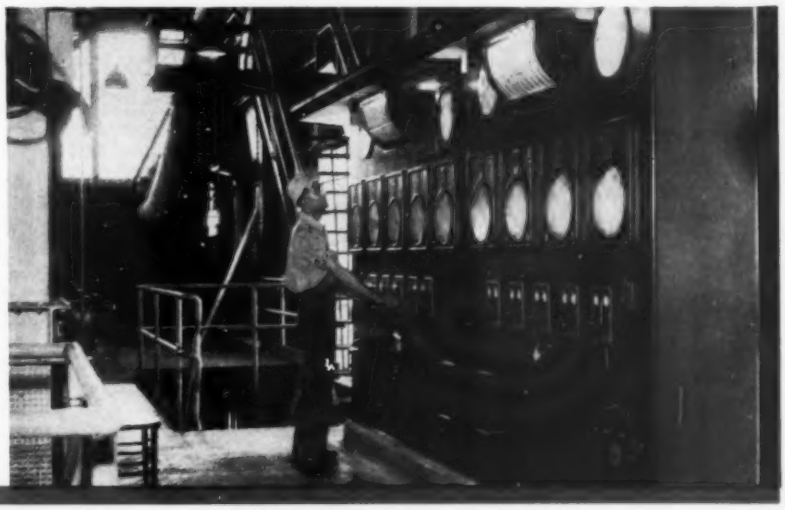
Softened make-up water is conducted from the treated water standpipe of the existing water treating plant to the new boiler house through a new 8 in. line. This line is installed partly underground and partly within the old boiler plant. Two 500 gpm centrifugal pumps boost the water pressure to permit its induction directly into the feedwater heater. These pumps are turbine driven at 3500 rpm and are capable of producing a total dynamic head of 100 ft.

Heated feedwater is pumped to the new boilers, and to several of the older boilers at certain times, by two turbine driven centrifugal pumps of 500 gpm capacity against a head of 673 ft.

Internal boiler water treatment is provided from a 200 gal make-up tank. Small adjustable stroke piston pumps inject phosphates directly into the boiler drums.

Combustion Control

A complete combustion control system was furnished for the new boilers. Filtered and cooled plant air is employed as the actuating medium for the controls. Fuel feed, forced and induced draft fan speeds, and damper positions are all adjusted in accordance with the demands for steam. Manual controls are provided so that either or both units can be "base loaded" with respect to total plant steam demand or can be caused to carry more or less than a proportional share of total plant load. Feedwater level is controlled by a three-element control system. A complete compli-



Control panel which serves both boilers is installed midway between the units and at level of burner windboxes.

ment of indicating, recording, and integrating meters and gages is installed for guidance of the operators and for future study of operations.

Ash Disposal

As boiler furnaces are of the dry bottom type, all ashes from furnace, boiler pass, and air heater hoppers are conveyed to an overhead tile storage tank by a steam operated pneumatic ash handling system. This tank is located directly over the railroad siding and has a capacity of 65 tons of dry ash. Unloading from the tank to a railroad car or truck is accomplished by use of a "pug mill" type of dustless unloader which mixes a controlled quantity of water with the ash.

To economize in the use of treated water, raw river water is utilized for bearing cooling and ash disposal. This plan required the installation of filters with a capacity of 100 gph and a booster pump of 30 gpm capacity to serve only the exhauster at the top of the ash tank and the dustless unloader. The booster pump operates only when ashes are being handled in the plant or when the ash tank is being unloaded.

Preliminary plans called for the removal of six blast furnace gas-fired boilers (installed in 1905) to provide space for the two new steam generators. Careful study, however, revealed that such a plan would be impractical. Steam loads during the months the installation was to take place were anticipated of such magnitude that not even the oldest steam generating unit could be removed from service to permit clearing of the site. Furthermore, at that time surplus blast furnace gas would be available until the new coke ovens, then under construction, were prepared to burn it under their retorts. Finally the new boiler units were installed at the south end of boiler house No. 3 to avoid any interference with operations during the erection period. Choice of this location provided the additional advantage of having the heaviest users of coal closest to the point at which the fuel is unloaded from railroad cars.

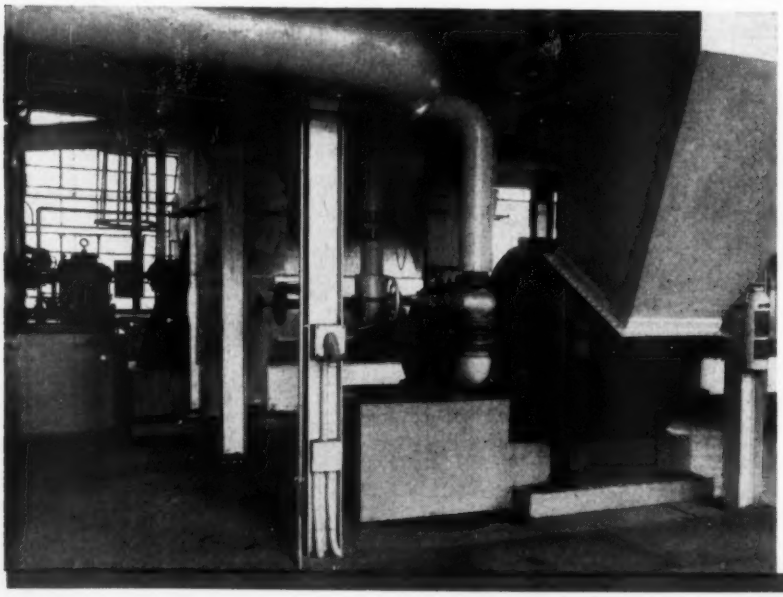
Coal hoppers (above) provide gravity feed to new pulverizers and are so situated that the traveling crane can still reach most of the original bunkers.

Coal Handling

Only minor changes of coal handling facilities were required for the new installation. All coal-fired units in the boiler house are served by a single traveling crane which dips coal from gravity-fed car unloading pits located opposite the new units. Additional coal hoppers were installed in the crane bay in such a manner as to permit gravity feed to the pulverizers. Size of these hoppers was limited by the fact that access to the fuel pits could not be so restricted as to make crane operation tedious. Forty ton capacity hoppers were found to be large enough to accommodate the pulverizers and still permit access to three-fourths of the fuel pit area. Location of the new hoppers has also resulted in a considerable saving of crane travel time.

LIST OF PRINCIPAL EQUIPMENT

Steam generators, air heaters, and pulverizers—Babcock & Wilcox Co.
Fans—Sturtevant Division, Westinghouse Electric Corp.
Flues, ducts, and stacks—Sharpsville Steel Fabricators, Inc.
Deaerating feedwater heater—Cochrane Corp.
Pumps—Ingersoll-Rand
Internal boiler water treatment— Proportioneers, Inc.
Turbines and gears—Terry Steam Turbine Company
Ash disposal system—United Conveyor Corporation
Raw water filters—Cuno Engineering Corporation
Instruments and controls—Bailey Meter Company
Stairs, grating, and handrails—Standard Metal Products Co.
Structural steel & coal bunkers—American Bridge Co.
Valves—Crane Co.
Soot blower—Diamond Power Specialty Co.
Boiler settings—The Rust Engineering Co.
Feedwater regulator—Bailey Meter Co.
Water level indicator—Bailey Meter Co.



Both the induced draft fan (left background) and forced draft fan (right) for each boiler are turbine-driven.

CONDENSER SYSTEMS NEED PLANNING TOO

Since approximately half of the turbines installed recently in industrial power plants have been condensing units, this well qualified engineer-consultant, recognizing the need for such information, discusses the various factors involved and outlines step-by-step procedures governing selection of the proper equipment. This is the first article of a series.

TYLER G. HICKS,
Engineer, Hicks Associates, New York

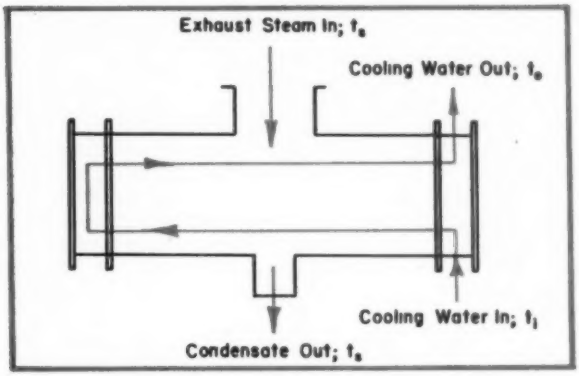


Fig. 1 — Diagram of two-pass surface condenser, showing the temperatures which must be considered when evaluating performance.

TURBINE installations in industrial power plants have so changed in character in recent years that now about half the new units going into operation are equipped with condensers. Between 1941 and 1946 fifty-nine industrial plants installed new turbines, and thirty-two or about 54% of these plants were provided with condensing turbines. Forty-one industrial power plants purchased new turbines in '46, and in nineteen of these or about 46% condensing units were installed. In '48, a total of ninety-one industrial plants expanded generating facilities, and forty-four, or about 48%, were supplied with condensers. These figures indicate clearly that industrial power plant engineers and operators must today be familiar with the many problems encountered in condenser system plan-

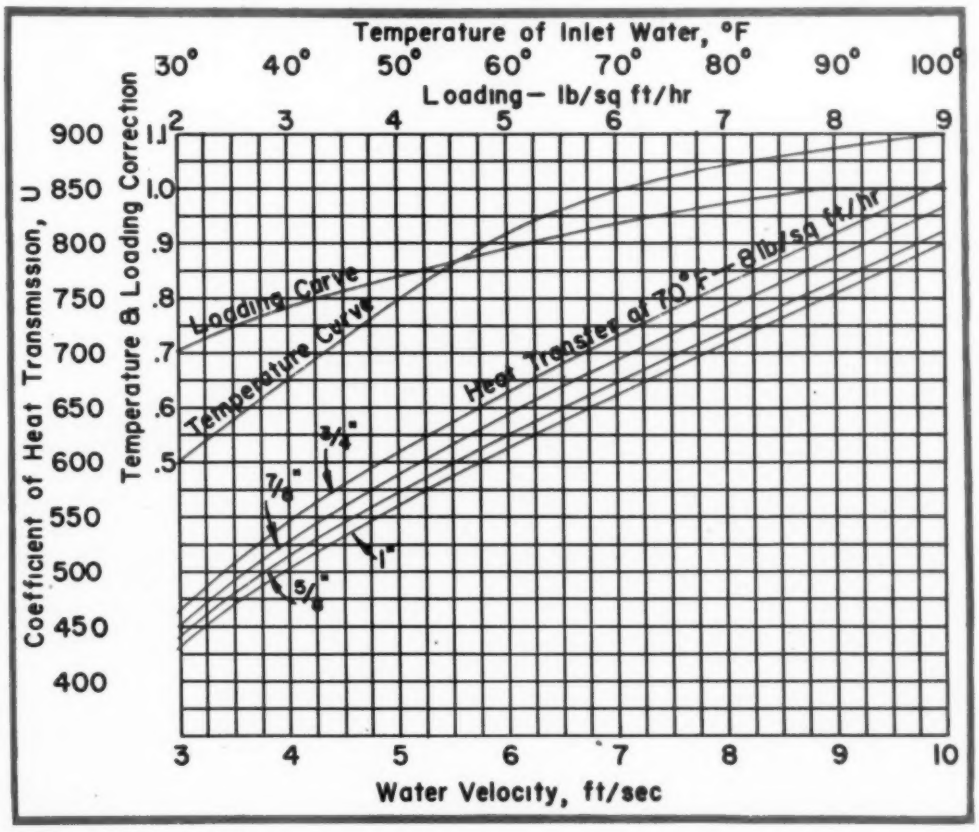

Temperature of Inlet Water, °F
30° 40° 50° 60° 70° 80° 90° 100°
Loading — lb/sq ft/hr
2 3 4 5 6 7 8 9
Coefficient of Heat Transmission, U
900 850 800 750 700 650 600 550 500 450 400
Temperature & Loading Correction
1.1 1.0 .9 .8 .7 .6 .5
Loading Curve
Temperature Curve
Heat Transfer at 70°F — 8 lb/sq ft/hr
3/4"
7/8"
1"
5/8"
3 4 5 6 7 8 9 10
Water Velocity, ft/sec

Fig. 2 — Heat transfer coefficients and correction factors for standard power plant surface condensers are supplied by this graph.

ning and operation. Therefore, to provide a good working knowledge of these problems and the best means of solution, a study of modern industrial power plant condensing systems will be made.

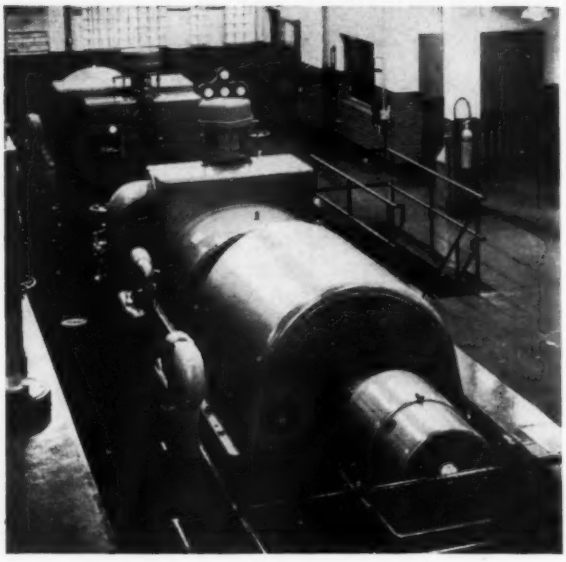
Planning

Studies of typical conditions encountered in industrial power plant planning indicate major problems in connection with the selection of 5 classes of equipment, namely: (1) condenser, (2) circulating water pump, (3) condensate pump and control, (4) steam jet air ejector, and (5) atmospheric relief valve. Each problem is related, either directly or indirectly, to the other, and to obtain a successful condensing system, all problems must be solved in terms of the effects upon other variables in the system.

Assumption is made, in this discussion, that the turbine and generator have already been selected. The problems must be limited in this respect because a discussion covering generating unit selection also would be too lengthy. Therefore, the assumption will be made that a 3000 kw turbine with a 400 psi gage throttle pressure, 250° F throttle superheat and 28 in. vacuum (referred to a 30 in. barometer) has been chosen for the plant load. The steam rate of the turbine is 10.6 lb per kwh. No steam will be extracted from the turbine.

Condenser

To select a condenser the following facts must be known: (a) steam flow to condenser, (b) absolute pressure in condenser, (c) temperature of available cooling water, (d) tube length, (e) water velocity through tubes, (f) number of water passes, (g) tube size, and (h) cleanliness factor. The first three items are obtained from the turbine rating and plant locality. The remaining items are either assumed or are the same as those of previous installations in the particular plant.



With so many condensing turbines being installed in industrial power plants, engineers and operators need to be familiar with condenser system planning and operation.

Maximum weight of steam condensed is (3000 kw) (10.6 lb per kwh), or 31,800 lb/hr. Absolute pressure in the condenser is 30-28 or 2 in. Hg. Steam tables show the saturation temperature at 2 in. Hg to be 101.14° F. The maximum inlet water temperature in the plant's locality is 75° F. Previous plant installations are regarded as duplicated, so the following apply: tube length, 14 ft; no. of passes, 2; tube size, ¾ in. dia, 16 BWG; water velocity, 6 fps; and cleanliness factor, 0.85.

Since surface condenser sizes are normally based on area of the condensing surface and tube length, area will be determined first. When the outlet temperature of the cooling water is unknown, the area cannot be found directly; consequently it must be determined by progressive solution of a series of basic condenser equations. First,

$$t_o = t_s - \frac{t_s - t_i}{e^x} \quad \ldots\ldots\ldots\ldots (1)$$

t_o=cooling water outlet temperature, °F

t_s=saturation temperature of steam entering the condenser, °F

t_i=cooling water inlet temperature, °F

e=2.71828

x=an exponent=KlU/500V

K=a constant from Fig. 3

l=tube length, feet

U=heat transfer, Btu/sq ft hr/°F log mean temp difference

V=water velocity in tubes, fps.

Quantity U is found to be 665 by entering Fig. 2 at a water velocity of 6 fps and projecting vertically to the ¾ in. tube curve. This value must now be corrected for cleanliness and inlet water temperature. The temperature correction factor is read from Fig. 2 as 1.02 for a 75° F inlet temperature. Then,

$U = 665(1.02)\ (0.85) = 576$

$e^x = 2.71828^{1.122} = 3.07$

$$t_o = 101.14 - \frac{26.14}{3.07} = 92.6°F$$

Once the outlet temperature is known the condenser area is found from:

$$A = \frac{950\ W}{U(MTD)} \quad \ldots\ldots\ldots\ldots (2)$$

A=condenser area, sq ft, measured on the outside of the tubes

W=weight of steam condensed, lb/hr

MTD=log mean temperature difference between steam and

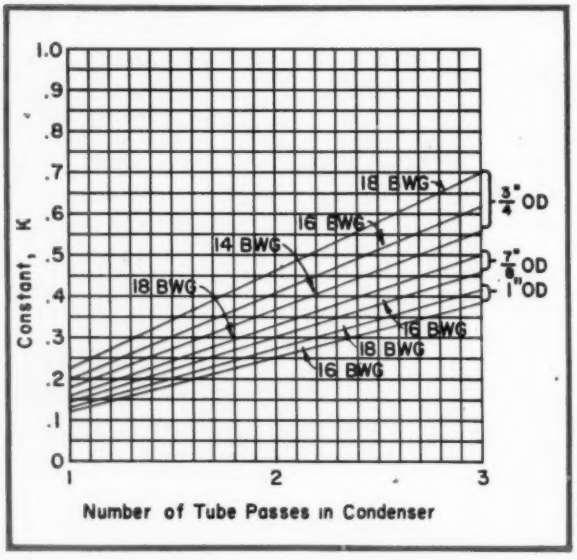


Fig. 3—Values of "K" for use in condenser heat transfer calculations. Text supplies details of tube thickness and size choice.

$$\text{cooling water} = \frac{t_o - t_i}{\log_e \frac{t_s - t_i}{t_s - t_o}}$$

$$A = \frac{950(31{,}800)}{576(15.7°)} = 3{,}340 \text{ sq ft}$$

Amount of cooling water required is given by

$$Q_{gpm} = \frac{1.9W}{t_o - t_i} \quad \ldots\ldots\ldots\ldots (3)$$

$$Q = \frac{1.9(31{,}800)}{92.6 - 75} = 3{,}430 \text{ gpm.}$$

However, these calculations must be checked to determine whether or not the indicated condenser conforms with standards set up by manufacturers. Minimum water flow rate permissible is 3 fps. Since a 6 fps flow rate was assumed, the condenser is satisfactory in this respect. A terminal temperature difference of not less than $t_s - t_o = 5°$ F is required. For the operating conditions in this problem, this difference is 101.14—92.6= 8.54° F; therefore the computed performance is suitable.

Condenser loading, or pounds of steam condensed per sq ft of surface per hour is—

$$\frac{W}{A} = \frac{31{,}800}{3{,}340} = 9.54 \text{ lb/sq ft.}$$

Study of Fig. 2 reveals that a loading correction is unnecessary when 8 or more lb/hr/sq ft is condensed. If the loading had been found to be less than 8 lb/sq ft, the loading correction factor from Fig. 2 would have had to be applied and the computed value of U multiplied by the correction factor. Then cooling water outlet temperature, condenser area, water quantity, and loading would have to be recomputed. Should the loading still be less than 8 lb/sq ft, Fig. 2 would have to be studied again to ascertain if application of the new correction factor would change the value of U considerably. If so, similar calculations would have to be made until the correction factor would change the value of U only slightly—say not more than 1%. Results obtained in the final calculation would be assumed to approximate, rather closely, actual operating conditions.

Basic relations given here are usually sufficient for preliminary determination of condenser size and cooling water flow rate. Once the required area has been found, the actual area is selected from a manufacturer's listing of standard units. Usually the next largest area is chosen. In this instance, a 3500 or 4000 sq ft condenser would probably be selected in accordance with the standard sizes available. By means of similar calculations, the loading in the actual condenser can be found. With a 3500 sq ft condenser, application of the loading correction factor is not necessary. If a 4000 sq ft condenser were selected, a slight correction for loading would be necessary—but the resulting change in operating conditions would not be appreciable.

Factors

Several assumptions were made, in the problem under discussion, in order to illustrate a typical procedure. In the following, principal factors that usually affect these assumptions will be given to provide a guide in the actual selection problems.

Modern condensers may be single or multiple-pass design. Choice of the number of passes, when not governed by previous installations in the specific plant, is affected by several factors, viz: temperature and quantity of cooling water available, cost of power for circulating pump drive, and the cost of money for extra investments. All these influence the number of passes chosen. For many industrial plants near large rivers or lakes, where a plentiful supply of low cost water is available and pumping head are low, a single pass condenser is suitable. Where cooling water supply is limited, expensive, or must be pumped at high heads, 2- and 3-pass condensers are most often applied. Also cooling towers and ponds are frequently provided in conjunction with multiple pass condensers.

Condenser tube sizes usually vary between 5/8 in. and 1 in. outside diameter, the selected size depending upon the condenser capacity, allowable pumping head, and general de-

(Continued on page 122)

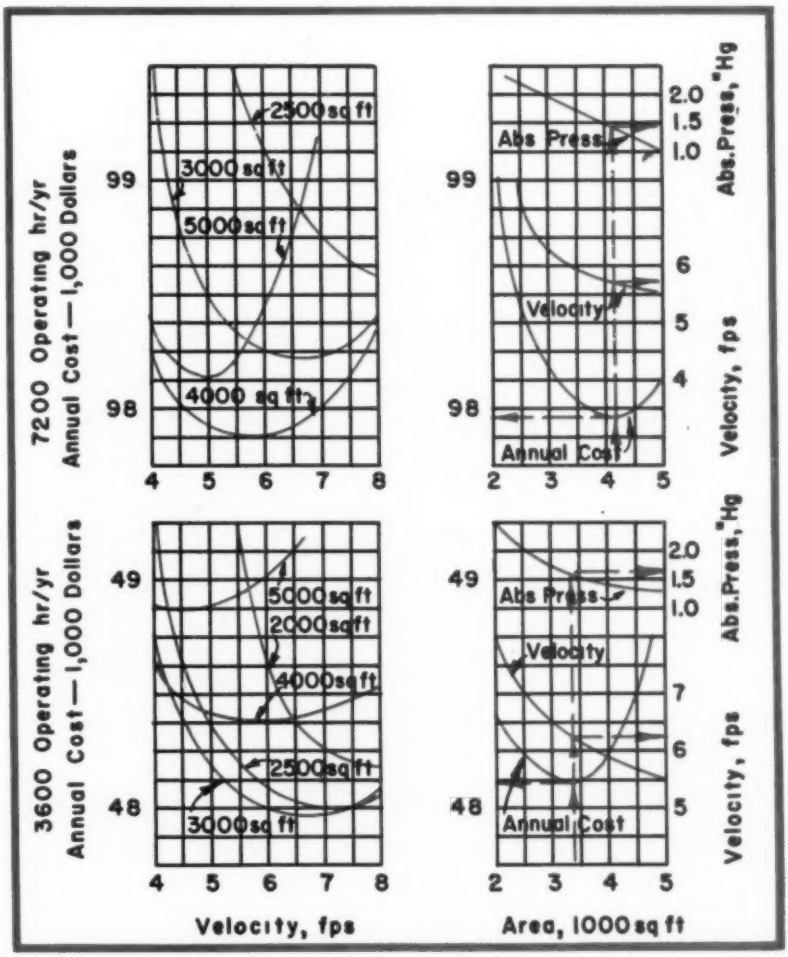


Fig. 4—Typical graphical determination of most economical area, water velocity, and absolute pressure for a power plant surface condenser. When condenser operates 3600 hours per year, the minimum annual cost is obtained with a 3400 sq ft unit, a water velocity of 6.2 fps, and an absolute pressure of 1.6 in. Hg (lower curve). A 4200 sq ft condenser would be most economical for 7200 hours operation per year (upper curve). Costs, areas, velocities, and other values used to plot these curves are valid for a specific plant, as respective values vary according to plant locality.

CHOICE OF DUST COLLECTING SYSTEMS GOVERNED BY MANY FACTORS

This article outlines the pertinent data plant engineers must explore and evaluate before an intelligent selection of dust collecting systems can be made. Dust characteristics, coverage of major types of collecting equipment now available, and design of hoods and piping are discussed in detail. Several examples of special arrangements and the solutions of difficult problems are cited as indicative of what imaginative engineering in this field can actually accomplish.

CHALMER R. CLINE,
Assistant to President, American Wheelabrator and Equipment Corp.

ONE problem being encountered with increasing frequency by plant engineers is the choice of a suitable dust collecting system for a specific operation or for a room or an entire building. Engineers approaching this situation for the first time or without considerable experience with air pollution are apt to feel bewildered by the wide variety of dust collecting devices on the market and the many general claims being made as to their efficiency and applicability.

Actually, each of the major types of dust collectors has a favorite field in which it is exceptionally efficient, but these fields overlap to a degree and no hard and fast rules can be established. Many factors—such as the size of the dust particles, their chemical stability, the cleaning efficiency desired, the dew point of the carrying air, the temperature, the cost of installation, and others—will affect the final choice of equipment.

When serious dust problems arise, the services of specialists in the field of dust suppression and collection should be acquired. In cases where conditions do not warrant the retaining of a consulting engineer, manufacturers of dust collector equipment usually have qualified personnel available to study the problem and recommend the type of equipment that will best serve the purpose.

However, the average plant engineer likes to be able to analyze such problems himself and determine, at least in a general way, what equipment is required. The following discussion will help in making the preliminary analyses, but it is not intended as the final word on the choice of dust collector equipment.

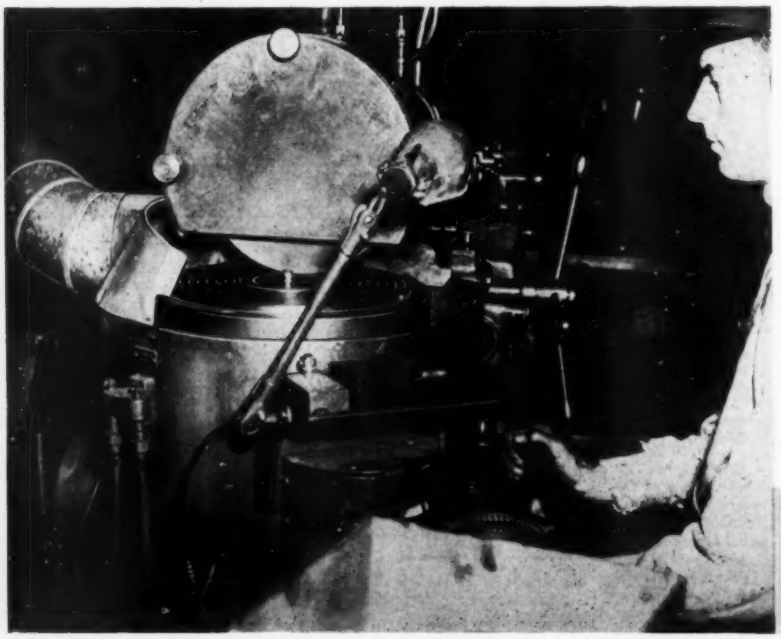


Fig. 1—Hood on this surface grinder is designed so that dust particles are drawn away from the operator's face. To achieve efficient performance consideration was given to velocity of particles leaving operation.

Dust Characteristics

Obviously the first factor to consider in relation to a dust problem is the question of whether the collection of the dust is desirable or necessary. The dust may be valuable and worth saving; or it may be a health hazard and must be removed from the working area; or it may simply be a nuisance, the removal of which will improve worker efficiency and reduce machine maintenance.

The next step to be considered is the characteristics of the dust itself and the carrying gas. This basic information is usually available by the simple expedient of measuring and observing.

Aside from the obvious "What is it?", the following four facts about the dust must be known:

1—Particle size. This data is important not only from the point of view of choice of collector but also because of health requirements. In many codes, designed to control the handling of pathologic dusts, the minimum permissible dust concentration is written as "less than ten million particles (smaller than ten microns) per cubic foot of effluent air".

2—Apparent density. Density affects the rate of flow required through the duct work or piping to prevent dust from settling out and is an important influence on the choice of collector. The term "apparent density" is used to take into consideration the fact that many materials—in a finely divided state—exhibit flotation characteristics which would indicate a specific gravity considerably lower than the handbook figures for the material.

3—Chemical stability. This factor is extremely pertinent because of the possible corrosive effect of many materials. Consequently the presence or absence of water vapor in the carrying gas, as well as the probable construction materials of the ductwork and collector, must be taken into consideration.

4—Hygroscopicity. Materials that possess the ability to absorb moisture out of the air usually have a tendency to cake on the walls of the duct work, to plug filter fabrics, and generally build up back pressure to a point where practically no air is flowing. Even if the cake is not allowed to build up to a point where air flow is seriously reduced, power requirements may be increased.

Gas as Carrier

Ordinarily the carrying medium for dust is air, but in some instances the carrier may be some other gas. Where the carrier is not air, the composition of the gas, its chemical stability, and hygroscopicity should be known.

In addition information on the following factors is necessary:

1—Temperature. This will have an important effect on the material used in the collector as well as on possible chemical reactions that may take place in the system.

2—Dew Point. Where dust has hygroscopic characteristics or where water affects its chemical stability, the dew point is of especial importance.

3—Other Gases. The presence of small volumes of gases other than the primary carrying medium should be taken into consideration because of possible corrosive characteristics.

Types of Collectors

In general, four distinct types of dust collectors are available: (1) The filter, which includes equipment employing a special filtration medium such as felt, or a fibrous material wetted with a heavy oil, or a simple cloth where the dust itself builds up a filter cake; (2) the cyclone, in which dust is separated by centrifugal force as the air whirls through a cylindrical or conical shaped chamber; (3) the electrostatic precipitator, wherein the dust is subjected to a strong unidirectional electric field so that the particles are attracted to one of the electrodes; and (4) the wet type collector, this classification including all collecting devices based on the principle of trapping the dust in a liquid spray.

The problem of defining the range of application for each type of equipment is naturally complicated by many controversial and competitive questions. Therefore the range of applicability of each group will be covered in only the most general terms.

Filter type collectors offer high collecting efficiencies at moderate costs, but some are limited in application by the temperatures and chemical attacks that the filter fabric will withstand. Recent developments in fabrics and techniques have greatly increased the range of materials that can be handled in this type of equipment.

Cyclone type collectors provide a satisfactory degree of collection efficiency, if the solids are not too finely divided, at a reasonably low initial investment. Since the efficiency of such units is affected as the particle size decreases, cyclones are frequently used in series with other types of collectors to reduce, usually, the over-all cost of the installation.

Electrostatic precipitators are particularly well-suited to the removal of fine dust particles from high temperature gases. The initial investment is relatively high and varies with the degree of efficiency desired, but many applications exist in which no other type of collector will perform as well.

Wet type collectors find their largest application in the removal of mists and fumes from the air. Gummy materials, which would foul the electrodes of an electrostatic collector or the fabric of a filter type, can be successfully washed away by the use of a water spray. This type collector has the added feature of discharging a thoroughly wetted dust which simplifies disposal in some cases.

Hooding

A less controversial subject is the question of hooding and the value of local vs. general ventilation. In almost all cases the most desirable method is to remove the dust at the source before it has had a chance to spread through the working area. Naturally this practice involves the cost of hoods, but such an expenditure is a minor consideration when compared to the tremendous volumes of air required for general ventilation and the fuel cost for heating the air discharged from a generally ventilated shop. Local ventilation offers many advantages

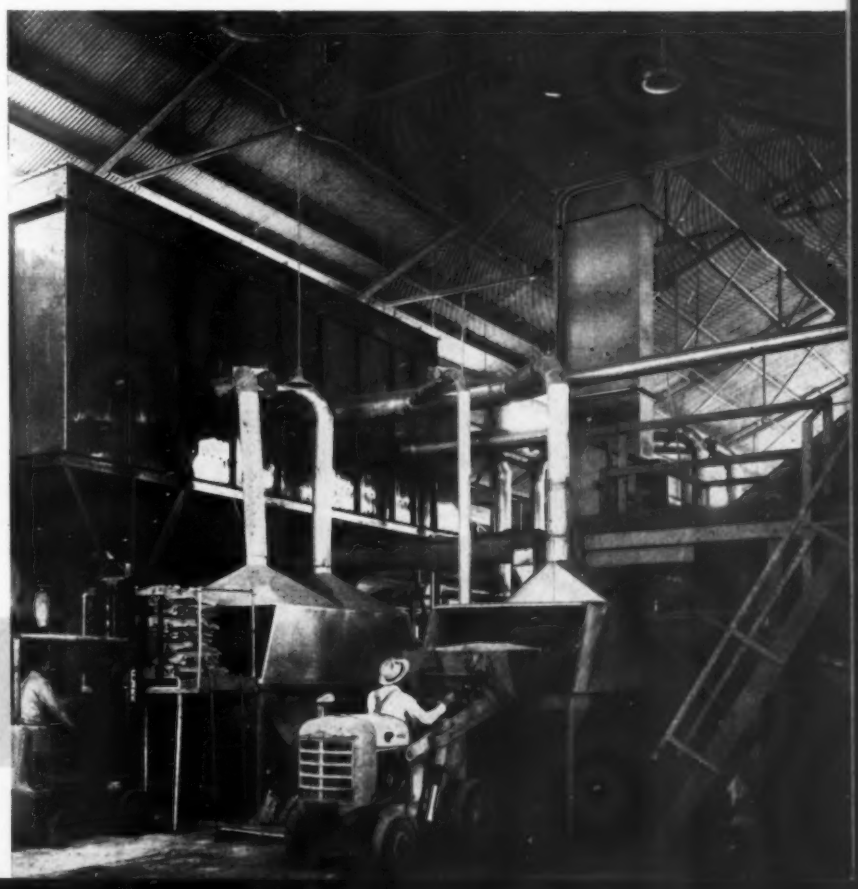


Fig. 2—Arrangement of piping from fertilizer mixers in a west coast plant is typical for ventilating a series of machines to one dust collector. Note the enclosed hoods which remove dust from dumping operations.

and economies, although considerable care and thought in hooding arrangements is required.

Exhaust hoods should be constructed according to the needs of the particular application (Figs. 1 and 2.) Dust creating operations should be enclosed as fully as possible without interfering unduly with the work. Moreover, the hoods should be as close as practical to the operation because of the rapid drop in air velocity away from the face of the hood.

Air velocities across the face of the exhaust hoods will vary according to the application, the distance from the face of the hood to the operation, and air currents in the building. Good practice dictates that an exhaust hood should not have more than 16 times the area of the connected exhaust pipe.

Hoods must be designed to take advantage of the force and direction of the dust particles leaving the operation. Heavy gases or dusts are usually handled to best advantage by means of hoods utilizing a downward flow of air. Fumes and light dusts are generally handled by employing an upward current of air into the hood. If either method interferes with the process, cross draft or lateral draft may be adopted. Furthermore hoods must be constructed so that flying particles or other dangerous materials are drawn away from the face of the operator.

Existing air currents—such as general building ventilation or adjacent operations—which might affect the hood efficiency should be carefully studied. Air currents detrimental to the proper operation of the hood can be prevented by means of baffles.

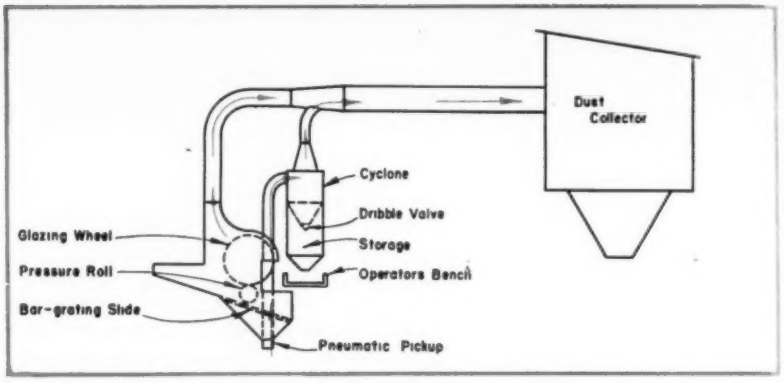


Fig. 3—Schematic layout of hooding and piping on saw glazing machine.

Structurally, a hood should be fabricated from materials best suited to the particular application, should be well-reinforced, and free of sharp edges. Movable hoods should be simple and have positive adjusting devices. Telescoping pipes or knuckle or ball joints in pipes are necessary with hoods of this type. Flexible metal or rubber hose can also be used with this type of hood.

Hoods should be equipped with doors to provide easy access to the ventilated equipment when adjustments or repairs are required. If desired the interior of the hoods can be lighted and dust tight windows installed to permit observation. Often an operation can be totally enclosed; in such cases the operator works through flexible sleeves and gloves attached to openings in the hood.

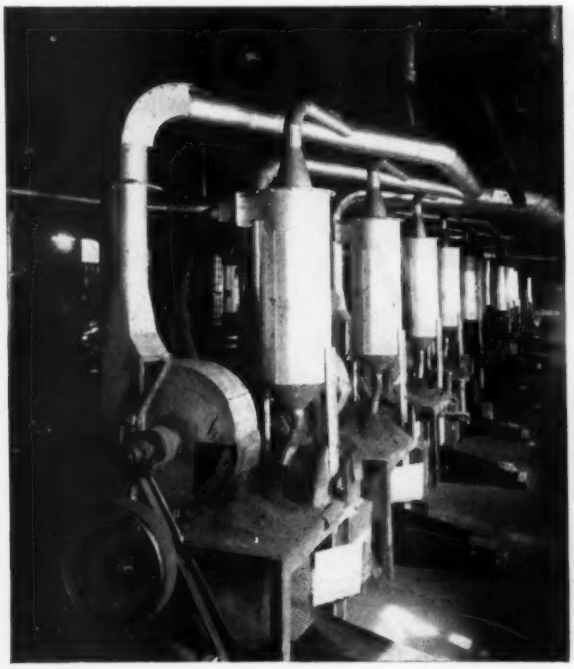


Fig. 4—View of a battery of saw glazing machines equipped with multiple dust collectors similar to the one shown in Fig 3. Fine abrasive dust is removed through hood over glazing wheel; heavier particles drop into hopper below wheel and are lifted pneumatically into cyclone collector.

Piping

Duct work or piping sizes are determined by two factors—the volume of air to be handled and the velocity required to keep the dust from settling out in the lines. These velocities will vary according to the physical characteristics of the dust being handled. Table I lists the arbitrary velocities usually set for some of the common dusts.

Of course power requirements rise as the frictional resistance of the line increases; consequently all bends, obstructions, and restrictions tend to build up this resistance. For that reason, piping should be run in as straight a line to the dust control system as possible, but the pipes must not interfere with cranes, trucks, or other major facilities.

Changes in pipe sizes should be made with a general taper of 5 in. length to every inch of diameter. The general practice is to keep the bottom of the pipe straight throughout its entire length. Branch pipes should enter the main line near the large end of the taper, preferably at the side or on top. Also the branches should enter at an angle of 30 to 45 degrees from the axis of the main. If constant velocities are to be maintained throughout the system, area of the main line must be equal to the sum of the areas of all of the branch lines feeding into it up to any given point.

Metal Thicknesses

Joints should lap in the direction of air flow and should be riveted and soldered or have double-lock seams. Normally the following thicknesses of pipe material are recommended:

No. 20 gage for 4 to 12 inches diameter
No. 18 gage for 12 to 32 inches diameter
No. 16 gage for 32 inches diameter and over.

When abrasive wear is encountered, heavy pipework is best connected by

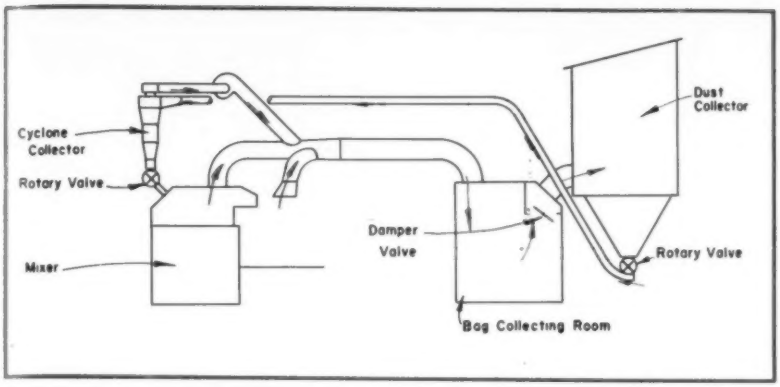


Fig. 5—This arrangement also serves as collector for empty paper bags.

bolted, flanged joints. Although the initial cost of this arrangement is somewhat higher, the method will prove cheaper in the long run—particularly when the pipe has to be replaced.

All pipes should be properly supported and have cleanouts with tight covers installed at intervals on horizontal runs and at bends and dead ends, where dust is most likely to settle. Blast gates for balancing the system should be located near the junction with the main line. Means should be provided for holding the gate slide in the desired position.

Elbows should be well-formed and made in seven sections if possible. The center line radius of an elbow should be twice the pipe diameter; or, better still, have a throat radius of 1½ diameters. Elbows should be constructed of material two gages heavier than the corresponding sizes of straight pipe. When abrasive materials are being handled, wear plates installed at the corners of a run may be desirable. An alternate method is to use rubber hose in place of elbows.

Special Features

With little or no added expense, an alert engineer can find many ways to greatly increase the value of a dust collecting system. Special arrangements can be devised to recover usable material, to separate various sizes of dust, convey materials pneumatically, effect temperature changes—to name but a few. The following are actual examples of this sort of imaginative engineering.

Customarily, in the glazing of hand and long saws, the operator scatters a handful of emery dust over the surface of the saw blank and then passes the blank through the rolls of a saw glazing machine. Usually the emery is piled on the floor next to the operator and he shovels a pile onto the table next to his machine whenever the abrasive is needed. After the saw passes through the glazing machine, the used emery falls on the floor and is scooped back onto the pile. Practically every movement is a dust creating one; good housekeeping is an impossibility.

Figures 3 and 4 illustrate a unique arrangement for ventilating the operation as well as for keeping the working area clean. The operator scatters a handful of emery over the blank as in previous practice and passes the blank through the rolls. The unit is carefully hooded and the fine dust is drawn off and carried to the dust collecting system. The heavier abrasive drops down through the bar grating into a hopper and is lifted pneumatically by the cyclone type collector mounted above the machine. The cyclone removes the reusable abrasive and drops it down into a storage hopper over the bench. A dribble valve feeds a constant supply to the operator's hand.

Fine dust from the cyclone is also carried to the main collector. Clean air leaving the dust collector is re-

TABLE I

Arbitrary Velocities for some of the Common Dusts

Material	Velocity (fpm) From	To
Sawdust, light, dry	2000	3000
Sawdust, heavy, wet, or green	3000	5000
Shavings, heavy, wet, or green	3000	5000
Wood blocks, edgings, heavy, wet, or green	3500	6000
Hog waste	3500	4500
Grinding dust	3000	4500
Foundry dust, tumbling barrel, shake-out	3500	5000
Sand blast dust	3500	4000
Buffing lint, dry	2500	3000
Buffing lint, sticky	3000	5000
Metal turnings	4000	5000
Lead dust	4000	5000
Cotton	2500	3000
Wool	3000	4000
Jute lint, flyings	2800	3000
Jute picker stock, shredded bagging	3000	3300
Jute dust shaker waste	3100	3400
Jute butts (conveying)	3600	4500
Grain	2500	6000
Ground feed, ½ in. screen (conveying)	4500	6000
Grain dust	2000	3000
Coffee beans	3000	4000
Shoe dust	3000	4000
Rubber dust	2000	4000
Bakelite molding powder	3000	3500
Bakelite molding powder dust	2000	2500

NOTE: These velocities are arbitrary—they are for general information only.

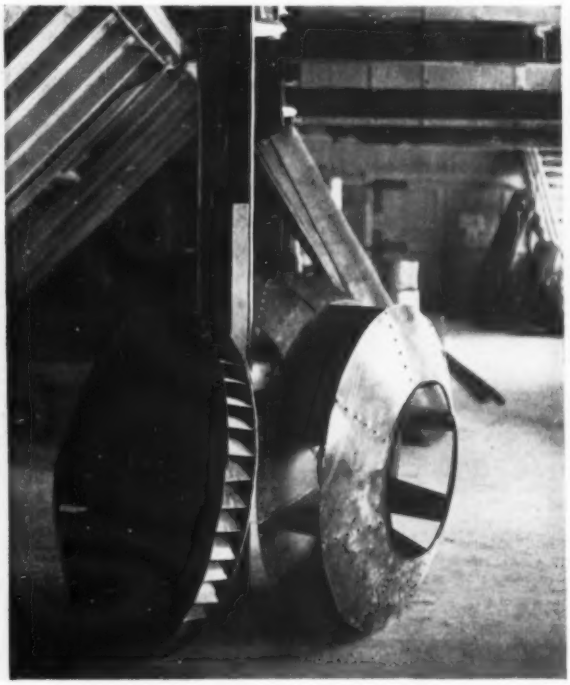


Fig. 6 — When an existing dust collecting system in an asbestos plant was enlarged recently, engineers found that by replacing the multi-bladed impeller (left) in the old fan with an 8-bladed impeller fan, efficiency was increased enough so that no additional horsepower was required for the new installation.

turned to the building with little loss of heat.

In the manufacture of rubber, the raw material and various dry ingredients, including carbon black, are dumped into a mixer and thoroughly blended. This is always an extremely dusty operation and some sort of ventilation is usually provided. The dry ingredients are received in paper bags, which constitute an additional dust source when they are hauled out of the mixing room for disposal.

Figure 5 illustrates a dust collector installation where the bag problem is solved in a simple and efficient way. The hood over the mixer collects and carries to the dust collector all dust created during the charging operation. As the operator empties a bag, he simply tosses it into the overhead hood to be conveyed pneumatically to a bag settling chamber which is also vented to the dust collector.

The turbulent action of the air stream removes all residual dust from the bag during transit and this, together with the dust collected during the charging operation, goes into the collector. When the collector bags are shaken, this dust settles in the hopper and is picked up by the cyclone collector and discharged back into the mixer.

A careful study of operating conditions in an asbestos plant, prior to the installation of a large dust collector system, revealed that obsolete fans were in use. However, by simply changing impellers, fan efficiency was increased enough so that no extra horsepower was required for the new system (Fig. 6). An additional 400 hp would have been required with the original impellers. This simple solution amounted to a savings of about $30,000 annually in power cost alone.

Similarly, a preliminary survey of dust collector requirements in a large porcelain enameling plant suggested a small but important alteration in the hooding arrangement on the spray booths. This change reduced the air volume required for proper ventilation. The dollar savings on the initial investment, as a result of this one minor move, ran into six figures.

These are a few of the more spectacular examples of the type of bonuses that can be obtained by intelligent dust collector engineering. Obviously many applications do not present the opportunity for improvements of this sort, but these situations happen often enough to be worthy of serious consideration.

Special Problems

In many cases the characteristics of the dust and the carrying gas present such serious difficulties that, at first glance, the problem seems incapable of practical solution. But in most cases relatively simple ways of solving the problem are usually available. The following paragraphs describe a few of the most common difficulties and some of the simpler ways of solving them.

In the first type of problem, the dust forms a hard cake upon contact with moisture. This action is usually complicated when the material is hygroscopic and the carrying gas has a high water content. The obvious answer is to keep the dust and gas temperature above the dew point until the gas has left the collector. This can be accomplished in several ways. In every case the dew point must first be determined. To avoid wide variations in temperature, the collector should be installed inside the building whenever practical (Fig. 7). The collector and ductwork should be insulated and/or heated if necessary. Water vapor itself will seldom be a source of trouble as long as it remains a vapor.

Another common problem is that of excessive temperature. On some installations this difficulty may be corrected advantageously by recovering the heat. The recovered heat can be put to some worthwhile use, as in the case of waste heat boilers. Other times, when the temperature reduction required is not too great, bleeding of cool outside air into the system will accomplish the purpose. This procedure means that increased air volumes must be handled; consequently, increased power and greater initial investment are required. Another factor to consider in this solution is the dew point.

Occasionally, when highly abrasive materials are to be collected, the question of excessive wear on the equipment arises. Such wear is difficult to correct completely but can usually be alleviated to a considerable extent. Since the rate of wear is a direct function of the velocity of the particles, the air flow should be kept as low as possible in the ductwork without running the risk of excessive settling in long runs. Bends should be avoided as much as possible. A settling chamber, as close to the dust source as practical, should be tried so that the heavier (and most troublesome) particles will settle out. Points of probable excessive wear must be located and wear resistant materials incorporated at these points.

Although this article does not cover all of the many problems that may arise in a dust collector installation, the more important ones have been discussed. Careful attention to each of these points will go a long way toward assuring satisfactory operation of the installation.

DON'T CLIP—DON'T TEAR

WRITE FOR TEAR SHEETS!

Rather than spoil this issue for other readers in your plant, let us supply you with copies or tear sheets of any of the articles for your files. Just drop a line to the editors — preferably on company letterhead.

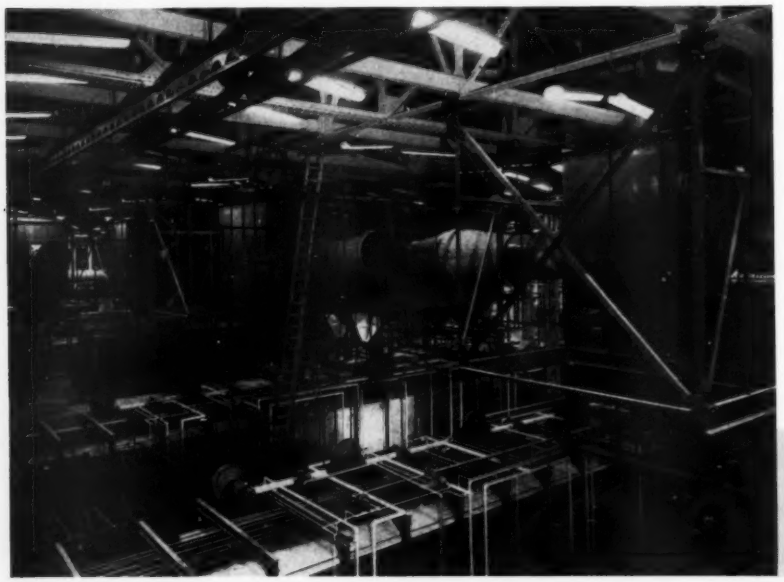


Fig. 7— To avoid excessive temperature variations, collectors should be installed inside the building whenever practical. Here collectors are being erected overhead in spaces that would ordinarily be wasted.

ECONOMICAL PF IMPROVEMENT REQUIRES PROPER EQUIPMENT

Application, location, and switching of synchronous motors and capacitors are stressed in this second part of a two part article on power factor improvement. Tables are given to aid in selection of equipment, and a typical plant problem solved to illustrate the value of a high power factor on an electrical distribution system.

R. MORGAN WILSON,
Industrial Power Division, General Electric Company, Schenectady, New York

FOR the most efficient operation synchronous motors or capacitors should be located as near the low power factor load as possible. Theoretically a synchronous motor might be connected to the terminals of an induction furnace transformer or a capacitor connected to the terminals of an induction motor. However, practically and economically this is not always justifiable; especially for the synchronous motor whose position is usually determined by its load. Location of capacitors is quite flexible but certain advantages can be gained if preference is given to the installation of these units in the following order:

1—On the terminals of an induction motor and switched with the motor, if the ckvar (capacitor kva rating) does not exceed the values given in Table II. Note: with this arrangement no separate switching device for the capacitors is required. 2—At the end of the secondary feeders, 3—On the utilization bus, where one capacitor bank can meet the diversified kilovar requirements of a group of loads, 4—On the distribution bus, similar to 3 above, 5—On the transformer primary but on the load side of utility metering (Fig. 1). The only saving here is in lower utility billing.

In practice the choice of location is often dictated by space consideration, but installation of capacitors is seldom difficult; although a cost comparison of two possible locations may sometimes be required to determine the most economical installation. For power factor correction synchronous motors may be located similar to capacitors but in the order of preferences 2, 3, and 4.

Switching

Some type of a switching device is required to connect capacitors in a circuit. This device should have mo-

TABLE I

MULTIPLIERS TO OBTAIN KILOVARS REQUIRED FOR POWER FACTOR IMPROVEMENT

Original Power Factor %	Desired Power Factor 100%	95%	90%	85%	80%
50	1.732	1.403	1.248	1.112	0.982
51	1.687	1.358	1.202	1.067	0.936
52	1.643	1.314	1.158	1.023	0.892
53	1.600	1.271	1.116	0.980	0.850
54	1.559	1.230	1.074	0.939	0.808
55	1.518	1.189	1.034	0.898	0.768
56	1.479	1.150	0.995	0.859	0.729
57	1.442	1.113	0.957	0.822	0.691
58	1.405	1.076	0.920	0.785	0.654
59	1.368	1.040	0.884	0.748	0.618
60	1.333	1.004	0.849	0.713	0.583
61	1.299	0.970	0.815	0.679	0.549
62	1.266	0.937	0.781	0.646	0.515
63	1.233	0.904	0.748	0.613	0.482
64	1.201	0.872	0.716	0.581	0.450
65	1.169	0.840	0.685	0.549	0.419
66	1.138	0.810	0.654	0.518	0.388
67	1.108	0.779	0.624	0.488	0.358
68	1.078	0.750	0.594	0.458	0.328
69	1.049	0.720	0.565	0.429	0.298
70	1.020	0.691	0.536	0.400	0.270
71	0.992	0.663	0.507	0.372	0.241
72	0.964	0.635	0.480	0.344	0.214
73	0.936	0.608	0.452	0.316	0.186
74	0.909	0.580	0.425	0.289	0.158
75	0.882	0.553	0.398	0.262	0.132
76	0.855	0.527	0.371	0.235	0.105
77	0.829	0.500	0.344	0.209	0.078
78	0.802	0.474	0.318	0.182	0.052
79	0.776	0.447	0.292	0.156	0.026
80	0.750	0.421	0.266	0.130	
81	0.724	0.395	0.240	0.104	
82	0.698	0.369	0.214	0.078	
83	0.672	0.343	0.188	0.052	
84	0.646	0.317	0.162	0.026	
85	0.620	0.291	0.136		
86	0.593	0.265	0.109		
87	0.567	0.238	0.082		
88	0.540	0.211	0.056		
89	0.512	0.183	0.028		
90	0.484	0.155			
91	0.456	0.127			
92	0.426	0.097			
93	0.395	0.066			
94	0.363	0.034			
95	0.328				
96	0.292				
97	0.251				
98	0.203				
99	0.142				

TABLE II

MAXIMUM CAPACITOR KILOVAR RATING TO SWITCH WITH AN INDUCTION MOTOR AS A UNIT

Motor Hp Rating	Motor Speed, Rpm					
	3600	1800	1200	900	720	600
	Capacitor Rating, Kvar					
10	2.5	4	4	5	5	7.5
15	2.5	5	5	7.5	7.5	10
20	5	5	5	7.5	10	12.5
25	5	7.5	7.5	10	10	15
30	7.5	10	10	10	12.5	15
40	10	10	10	12.5	15	17.5
50	12.5	12.5	12.5	15	20	22.5
60	15	15	15	17.5	22.5	25
75	17.5	17.5	17.5	20	27.5	30
100	22.5	22.5	22.5	25	35	37.5
125	25	27.5	27.5	30	40	47.5
150	32.5	35	35	37.5	47.5	55
200	42.5	42.5	42.5	45	60	67.5

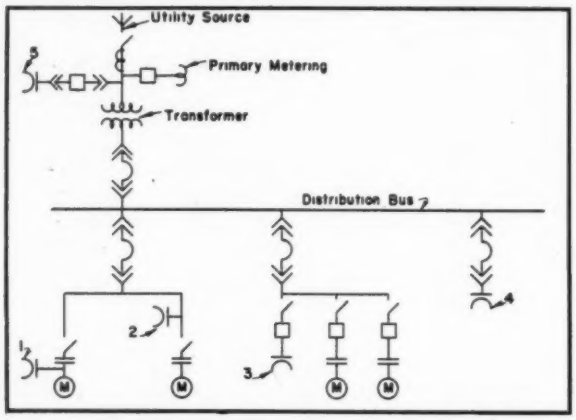


Fig. 1 — One line diagram indicates flexibility in the installation of capacitors in order of location preference.

mentary and interrupting ratings equal to the available short circuit current on the circuit.

Circuit breakers, when employed as a switching device, should have a continuous current rating of 135% of rated capacitor current, and switches and contactors 165% of capacitor current (Table III). At 600 volts and below, air circuit breakers and fused switches are often employed for manual switching, and breakers and contactors for automatic switching of capacitors. Above 600 volts power circuit breakers are generally installed for this purpose.

Application

Assume that a small plant wishes to analyze its operation with the hope of reducing its electric bills. No additional load which requires a motor drive is contemplated; therefore, capacitors will be installed as a source of kilovars.

The power rate is $1.00 per kva of demand per month, plus an energy (kwh) charge. The monthly electric bills for this plant show an average of 400 kw demand, 520 kva demand and 100,000 kilowatt-hours. The power factor is therefore equal to $\frac{KW}{KVA} = \frac{400}{520} = 76\%$. If the power factor were raised to 95% the kva demand would be reduced to $\frac{400}{.95} = 422$ kva and a saving of $(520 - 422) \times \$1 = \$98$ per month, or $1180 annually, would result. The energy charge would also be reduced because of lower system losses, and even though not ordinarily calculated this savings is well worth mentioning. Losses at 95% power factor are $\left(\frac{76}{95}\right)^2 = 64\%$ of those at 76% power factor.

A 400 kw load requires 210 kilovars (400 x .527—Table I) when the power factor is raised from 76 to 95%. If capacitors are employed to improve the power factor their installed cost can be estimated at $10 per kvar on this 460 volt system. Ten dollars per kvar can also be assumed for 575 volt capacitors, but 230 volt capacitors are estimated to cost $16 per kvar. The estimated equipment cost then is 210 x $10=$2100. The rate of return on this investment is $\frac{1180}{2100} = 56\%$ annually.

A one-line diagram of the distribution system is given in Fig. 2. Feeders 2, 3, and 4 serve induction motors. These circuits have low power factors and require kilovars. The pump on feeder 2 and M-G set on feeder 4A are large continuously running machines. In this case capacitors may be economically installed on the motor terminals and switched with the motor. From Table II the 75 hp, 1200 rpm pump motor can use 17.5 kvar (15 kvar is the nearest lower standard rating), and the 125 hp, 1800 rpm M-G set can use 27.5 kvar (nearest lower standard rating 15 kvar). Since the total amount that can be switched with the motors is 30 kvar, and since this is small compared with the total 210 kvar required, the most economical installation will be to switch the entire 210 kvar on the bus rather than divide capacitors. However, if the feeders were long with a high voltage drop, capacitors probably would be installed at the motors regardless of the greater cost.

Most power systems are constantly being expanded and future kvar needs should be estimated. The 500 kva primary transformer's maximum load at 95 percent power factor is 500 x .95=475 kw. If the future load will be the same type as the present 76%

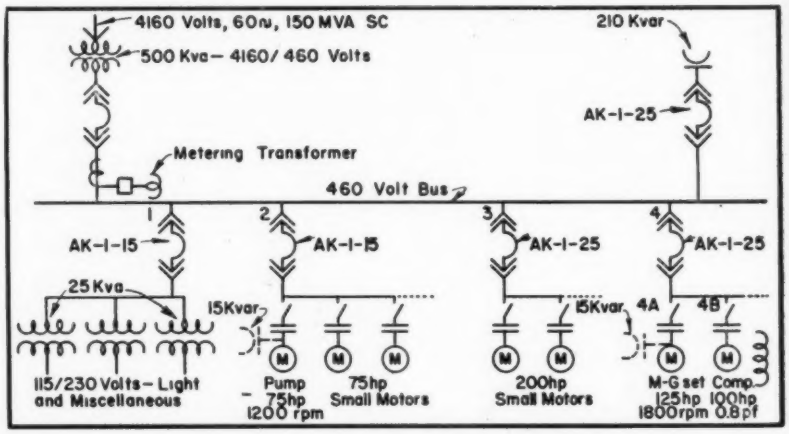


Fig. 2—Schematic diagram of a typical plant's electrical distribution system.

power factor load, the total kvar required at full load will be 475 x .527 =250 kvar. If convenient and not expensive, provision to add 250—210 =40 kvar of capacitors in the future should be made. Standard small rack 460 volt equipments are available in ratings of 30, 60, 90, 120, and 180 kvar; therefore two 120 kvar equipments, with one equipment less two 15 kvar units, will be used. The cost of the 240 kvar capacitor equipment is approximately $1450 not including a switching device.

When capacitors connected to a bus are switched, they are considered in the same manner as other loads except for the increased continuous current rating of the switching device. (Table III). To conform with the other switching devices on the bus, an air circuit breaker rated 240 x 1.69 =406 amperes continuous current (600 ampere frame size) is required to switch 240 kvar of capacitors at 460 volts. This breaker has an interrupting rating of 25,000 amperes, therefore it is adequate to meet the available short circuit current of 17,000 amperes on the bus. The cost of adding this breaker to the existing draw-out switchgear is $650.

If installation cost of the capacitors —including labor and cable—is assumed to be 10-15% of the cost of the equipment or approximately $200, the total investment is now $2300. This is somewhat larger than originally estimated mainly because a switching device which will handle 360 kvar($\frac{600}{1.69}$ =355, nearest standard capacitor rating is 360 kvar) is being applied for only 210 kvar, and space has been provided in the capacitor equipment for an additional 30 kvar. However, the rate of return on this installation is $\frac{1100}{2300}$ = 51% annually. In the future when the transformer is fully loaded at 475 kw, the saving on power bills will be (625—500) kva x $1 x 12 or $1500 annually and the investment $2470, an indicated rate of return of over 60%.

TABLE III

MULTIPLIERS TO OBTAIN APPROXIMATE CONTINUOUS CURRENT RATING OF CAPACITOR SWITCHING DEVICE
(Enclosed Rating & 40 C Ambient)

3-phase Service

Type of Switching Device	Voltage		
	230	460	575
Circuit Breaker, Magnetic Air	3.38	1.69	1.35
Circuit Breaker, Thermal	4.68	2.34	1.87
Contactor	3.76	1.88	1.5
Safety Switches	4.14	2.07	1.65

Synchronous Motor Application

Referring again to Fig. 2, for convenience, assuming the conditions originally set forth, also because of increased d-c requirements the M-G set on feeder 4A is to be replaced with a larger unit rated at 200 hp at 1200 rpm. In addition, the plant's power factor is to be raised.

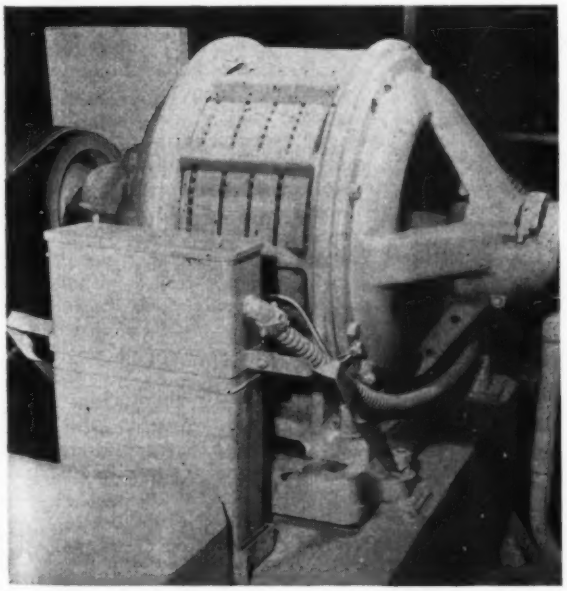
The present motor on the M-G set, when operated near full load, adds 85 kw at 85% power factor to the system peak demand. The kilovars required by this motor are 85 x .620 (Table I, factor for 85 to 100%)=53 kvar. The system kilovars are 400 x .855= 342. With the motor removed the system demands would be 400—85= 315 kw and 342—53=289 kvar.

Assuming the proposed induction motor has characteristics and loading similar to the present motor, it will require 136 kw and 85 kvar. An .8 power factor synchronous motor will also require 136 kw but will furnish 102 kvar to the system. Thus, with a new induction motor, the over-all power requirements of the system are 315+136=451 kw and 289+85= 374 kvar; power factor 77%. With a synchronous motor the power requirements are 451 kw and 289—102=187 kvar; power factor 94.5%. To put the induction motor and synchronous motor on a comparable basis, capacitors must be added to the system with the induction motor to raise the power factor from 77% to 94.5%. This requires 374—187=187 kvar of capacitors.

The induction motor and its control cost $4400 installed, and the synchronous motor including its control and exciter cost $6100 installed. However, the capacitors and breaker add $1950 to the cost of the induction motor and thus the total is $6350, or $250 more than a synchronous motor.

The additional cost of $1700 of a synchronous motor over the induction motor is an investment in power factor improving equipment which raises the power factor of a 451 kw load from 77% to 94.5% and reduces the demand 108 kva, (586 kva—478) a saving of $1300 annually, or a rate of return of $\frac{1300}{1700}$ =76.5%. The capacitor installation would have a rate of return of $\frac{1300}{1950}$ =66.5%. Therefore, the choice for this particular installation is a synchronous motor.

Regardless of the type of industry or the age of the installation, a plant's electrical distribution should always be operated at a high power factor for maximum economy.



In this installation an air circuit breaker was employed as a switching device for the capacitors.

SELECT STEAM TRAPS FOR SPECIFIC CONDITIONS

In this second part of his article on intelligent steam trap selection, the author details the various factors that must be considered if the right choice is to be made. The discussion covers types of traps to use for certain conditions, proper location of traps, and correct installation.

THOMAS TRAIL

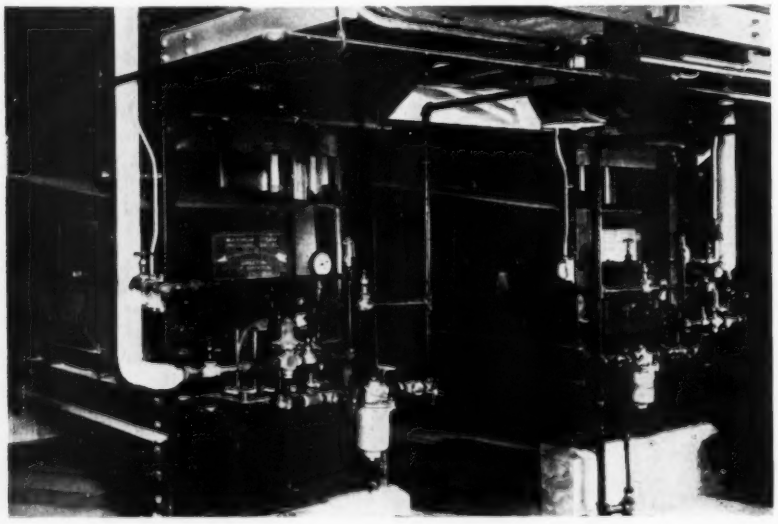
IN selecting the size of a trap for a particular application, the type of equipment to be drained, amount of condensate, and, for certain kinds of traps, the necessary safety factor, maximum pressure, and the working pressure differential must be known.

On such applications as draining a separator in the steam line to a turbine or engine, where little condensate is normally present but where boiler priming might suddenly produce a large slug of water, a float or bucket trap would be suitable. The elimination of air is of little importance but the trap must have a large enough condensate handling capacity.

When the problem involves only the continuous drainage of condensate —in steam lines for example—float or bucket traps may be employed. In certain cases, such as on steam lines to process equipment, thermostatic traps may be applied. If the line becomes flooded occasionally due to boiler priming, an oversize float or bucket trap is required.

Where unusually large quantities of condensate are to be handled, a compound trap may be employed. In this type, the opening of the valve serves to operate a piston attached to an orifice valve that permits the flow of large volumes of condensate. Such traps are usually selected for draining steam purifiers, separators, continuous blowdown systems, flash tanks, desuperheaters, and hot water heaters.

For applications of such nature that the venting of air from the equipment is of equal importance with the draining of condensate, a float or bucket trap in conjunction with a thermostatic air vent is satisfactory. Possible applications include the ends of heating coils or radiators, hot water heaters, and unit heaters. A thermostatic type trap may also be employed for drainage of this character if the expanding element will open before a temperature drop occurs in the equipment, or if the trap is provided with a cooling leg sufficiently long to prevent the condensate from backing up into the heating equipment. If the load does not vary greatly and the quantity of condensate drained is not too small, either an impulse or an orifice type trap might be adaptable. The impulse trap is described as floating on the load with the valve action constantly adjusting itself to the quantity of condensate to be discharged. For normal loads the valves open and close at short intervals; for heavy loads, it opens and stays open for full discharge.



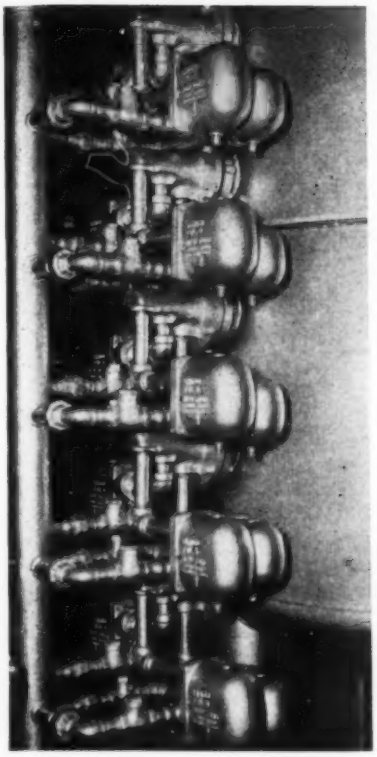
Inverted bucket type steam traps insure dry steam for drying equipment.

Selection

Condensation rate of steam heated equipment varies in accordance with the type, location, conditions of operation, and steam pressure. Therefore, wherever possible, information as to the quantity of condensate produced should be obtained from the heating equipment manufacturer.

Trap manufacturer should then be consulted to learn the factor of safety applicable to the type of trap selected under the operating conditions. Factor of safety is the number of times the actual condensate rate should be increased to determine the trap rating satisfactory for the application. The factor varies from 1 to 6 depending upon the kind of trap, type, and operating conditions of the heating equipment being drained. Where large quantities of condensate result from the heating up of cold equipment, the capacity of the trap must be proportionately greater to take care of such short duration overloads. The same conditions apply where considerable amounts of air must be purged quickly from the equipment to permit the entry of steam.

When certain traps, such as float and bucket, are employed, the inlet and differential steam pressures are important factors. Traps of these types must be selected to operate on the



Float-thermostatic traps on evaporator.

maximum inlet pressure but must have a sufficient capacity when operated at the lowest prevailing differential pressure. The latter represents the difference between the inlet pressure and the pressure in the return line, or the sum of the inlet pressure and the vacuum in the return line.

When data from the heating equipment manufacturer on the quantity of condensate produced is not available, or if the application is of such nature that the information can only be obtained from calculations, all pertinent information relating to the application should be submitted to the trap manufacturer to enable him to recommend a definite type and size of trap. The information furnished should include: the kind of heating equipment; type, metal, and square foot area of the heating surface; whether exposed to still or moving air or submerged in liquid (if submerged in liquid, mention kind and inlet and outlet liquid temperatures); operating steam pressure or pressures, and whether constant or fluctuating; and pressure or vacuum in condensate line.

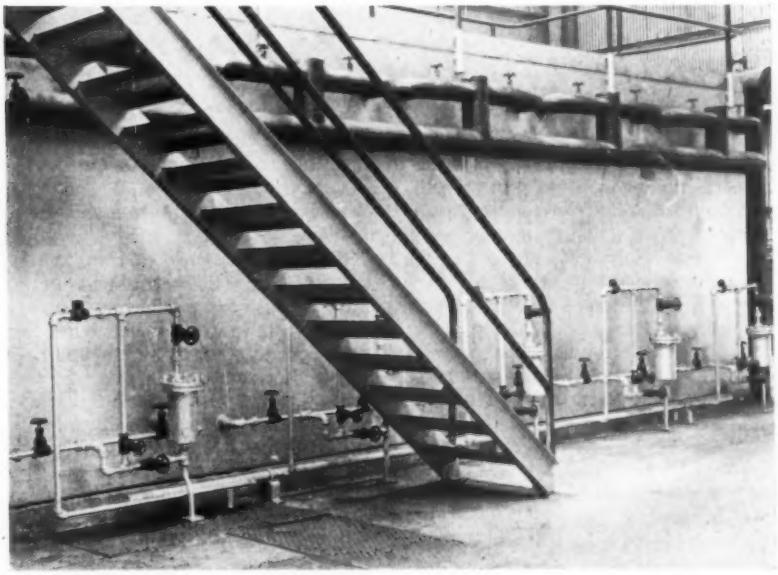
In the case of air moving over heated surface, the following data are necessary; the cfm of air flowing, as well as the entering and leaving air temperatures. Should steam jacketed kettles be involved, the capacity of the kettle in gallons, the heating time in minutes, and the kind of liquid being heated should be included in the information.

In the final selection of traps, care should be taken that all operating conditions are given consideration. If purifiers and separators are to be drained, the trap must have adequate capacity to handle any unusual slugs of water that may be encountered at any one time. The cost of a larger trap is small compared to the possible damage that might be caused by a slug of water reaching the steam consuming machine.

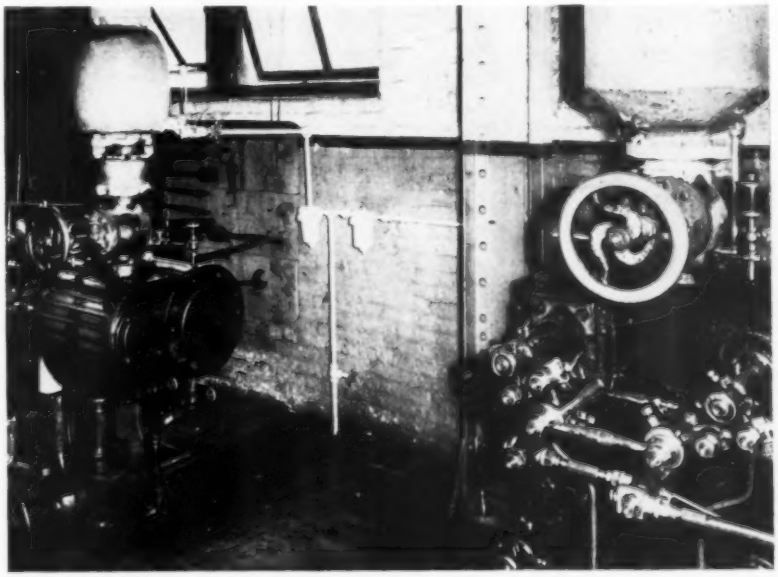
If the purifier also removes oil, discharge is necessary before the oil has time to cool and become thick. Some types of traps—such as the inverted bucket, impulse, and orifice—will accomplish this, since the oil passes through the trap.

In draining supply mains, a trap should be installed at intervals no greater than 300 feet. But regardless of the interval, a trap should be placed at each natural drainage point, namely: ahead of risers and reducing valves, at the bottom of loops, at the end of the main, and at any other point where condensate might collect or be harmful. Best results are provided with drip pockets, or a dam which is tack-welded in the main, to insure collection of the condensate.

On heated roll, chest, or plate type machines—for instance, a corrugated



Lines to palm oil tanks in tinning mill are served by inverted bucket traps.



Traps draining separators located in lines to steam engines.

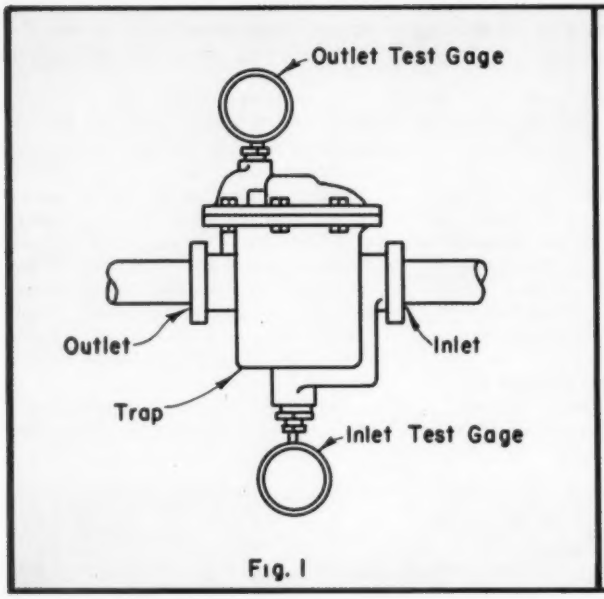


Fig. 1

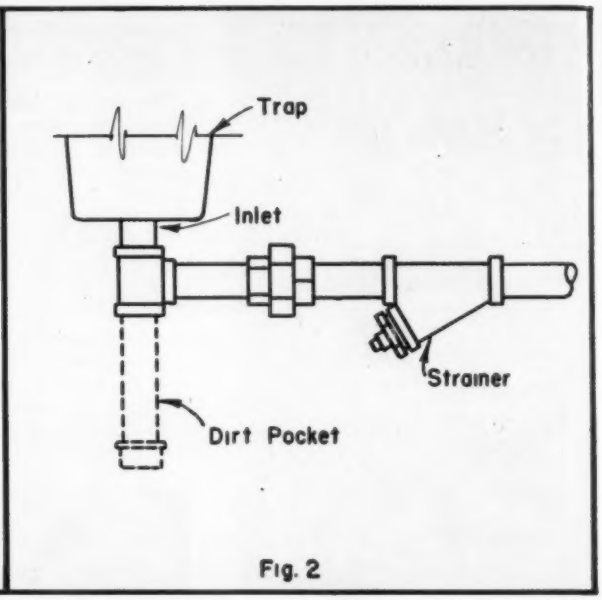


Fig. 2

paper making machine—each heated unit should be individually trapped. Also the units coming in contact with wet material should be equipped with larger capacity traps than the units handling semi-dry or dry material, since the condensing rate of the former will be faster. Individual traps should be employed on heating coils, unit heaters, air conditioners, and radiators to insure quicker heating of the apparatus and prevent short-circuiting.

Venting

To prevent corrosion and insure proper operation of certain steam heated equipment, as well as flow in condensate piping, air and water must be removed rapidly. This precaution applies especially to unit heaters. Adequate air and condensate handling capacity must be employed to prevent trapping of air and water in the bottom of the heater, because air is heavier than steam. If air is permitted to remain in the heater, core corrosion is likely to result.

Since the resistance to flow in certain types of equipment will lower the steam pressure at the trap inlet below that at the equipment inlet, the actual differential pressure at the trap should be determined by means of test gages (Fig. 1) in the trap inlet and outlet lines. This is especially important where low pressure steam is employed.

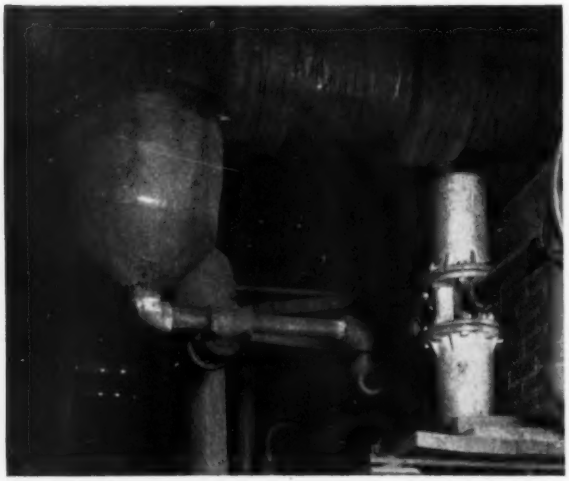
To insure proper operation of traps after they have been selected, the traps must be properly installed. Wherever possible, the trap should be located below and close to the equipment being drained—except in the case of thermostatic traps that are equipped with a cooling leg under conditions previously mentioned.

If gravity drainage to the trap is impractical, a check valve or a water seal should be provided in the trap inlet line to prevent back flow of prime from the trap body.

A vent line should be employed to prevent steam binding when a long line is necessary between the trap and the equipment being drained.

To protect the trap against dirt, chips, and scale, a dirt pocket or strainer should be placed in the inlet line (Fig. 2) and cleaned periodically.

Trap locations should be arranged for convenient maintenance, as this helps to prevent neglect. Similarly standardized pipe connections should be employed to permit quick replacement when repair or maintenance is necessary.



Compound trap serving steam lines in a Kansas City box manufacturing plant.

Impulse traps (equipped with strainers) help to keep cooking kettles hot for a California packing concern.

EXPERTS IN MANY FIELDS ADDRESS 70TH ASME ANNUAL MEETING

Evidence of the fast pace being maintained by the engineering world was amply supplied during 5-day gathering in New York. In addition to important discussions of the more usual topics, papers were given on human engineering, radioisotope by-products of nuclear energy, gas turbine locomotives, belt conveyors for moving people, and rocket airliners.

OF the many highlights of the well-attended annual ASME meeting in New York, November 27 to December 2, Dr. Lillian M. Gilbreth's address on "What Is Human Engineering?" provided probably the widest comment. Speaking at the "President's Luncheon", Dr. Gilbreth emphasized that in these times—when the human being is generally recognized as being more important than the machine and that human power supersedes "natural" power—the engineering profession has an opportunity to learn much from social scientists. In comparing the definitions and functions of the social science and engineering fields, the speaker recalled engineers' distaste for the term "Human Engineering". This dislike, she said, stems from many unfortunate experiences with non-engineering groups who call themselves engineers.

Human engineering is the application of engineering principles and techniques to the study and direction of people. "If human engineering is to be exploited", Dr. Gilbreth continued, "engineers must do the job. On the other hand, if people of other types of training are to do the work, they should not be called engineers".

Nevertheless, Dr. Gilbreth pointed out that engineers must utilize more and more the resources that come from learning from and working with "those who know most of the ways in which the human body, mind, and spirit function". If life were longer and time were available, it would be of great advantage to the engineer to be as thoroughly trained in the social sciences as he is in the exact sciences.

Atomic Tracers

Dr. Paul C. Aebersold, chief of the isotopes division of the Atomic Energy Commission, Oak Ridge, told an interested audience that radioisotopes, when employed as tracers, give scientists and engineers a method of analysis that is more sensitive and more specific than any other physical or chemical method of analysis now known. He explained that radioisotopes are useful as tracers for two reasons; first, radioactive isotopes of an element will exhibit the same chemical behavior as the stable species of the same element and will follow along through reactions and processes. Second, radioactive isotopes emit radiations whereby their identity and location can be determined, despite the number and complexity of the reactions taking place in a system.

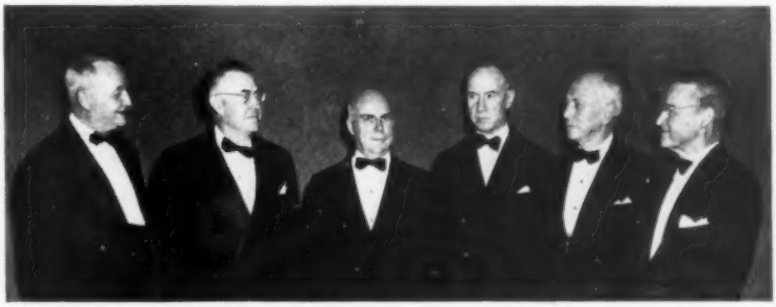
Dr. Aebersold cited several examples where radioisotopes have been applied with unusual effectiveness. For instance, in one type of friction study at the California Research Corporation, piston rings in gasoline and Diesel engines were made radioactive and the rate of wear of the rings was easily followed by making periodic measurements of the radioactive iron in the lubricating oil.

Another industrial application mentioned was that in which radioisotopes have been used as a marker for locating the boundary between two types of crude oil flowing through the same pipe line. The radioactive indicator is added just after one crude has passed through the line and just as the next crude is introduced. Many miles further along the pipe the detection of radiation on the outside of the pipe will indicate the presence of the radioactive material and the location of the boundary. This application offers tremendous possibilities for reduction of wastes in the petroleum refining fields.

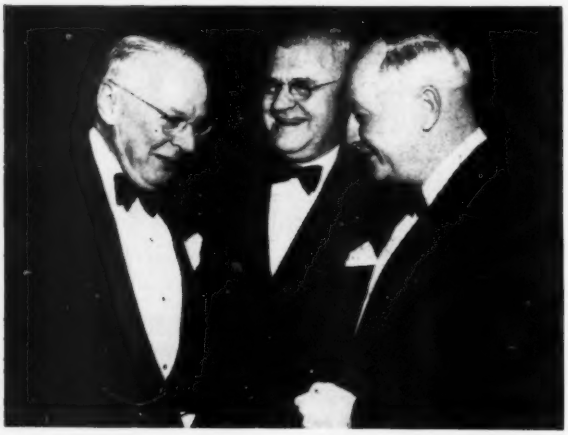
Dr. Aebersold said that the radioisotope applications which hold the most promise for the control engineer is the control or "gadget" types. Foremost among these are the radioactive height and thickness gages. Such gages have been designed to measure pliofilm, sheet paper, glass, and steel; they are more advantageous than other devices because, in addition to greater sensitivity and higher precision, they give measurements without mechanical contact or without stopping or cutting the rolling sheet.

Handling Radioisotopes

Another outstanding paper presented at the sessions held under the auspices of the Safety Committee and Machine Design Division was that by G. G. Manov, chief, and D. O. Lintz, health physicist, advisory field branch, isotopes division, Atomic Energy Commission, Oak Ridge. In view of the increasingly widespread use of radioactive by-products of atomic energy throughout industry, the paper explained in detail the methods which which have been found effective in the safe handling of radioisotopes at



Several of the ASME past presidents are greeted by James W. Todd, 1949 president, at annual dinner. They are (left to right): Mr. Todd, E. W. O'Brien, R. M. Gates, W. A. Hanley, A. D. Bailey, and D. R. Yarnall



James D. Cunningham (left), 1950 president-elect, being congratulated by C. E. Davies, ASME secretary and James W. Todd, retiring president.

large-scale installations. The authors stressed the fact that safety records indicate that atomic laboratories have proven to be less hazardous places to work than chemical or munitions plants.

In citing the AEC installations, Manov and Lintz revealed that the degree of security afforded by proper safety control can be made such that 98% of the workers receive less than one-fifth of the permissible weekly dose of beta or gamma radiations and that the other 2% of the workers seldom exceed the permissible dose in any one week. The authors said that non-hazardous employment of radioisotopes can be achieved through the use of proper detecting instruments, adequate laboratory equipment, and good common sense techniques. For the benefit of their listeners they described the various detection devices developed at Oak Ridge and other atomic laboratories.

ASME engineers were interested to learn that the AEC has established an advisory field service branch. The function of this qualified group is to provide assistance to those industries making use of radioisotopes for the first time. This help is offered by means of publications and by field trips to existing or proposed installations in the design of laboratories, safe handling of radioisotopes, disposal of unwanted material, standardization of measurements, and health physics monitoring and supervision.

Belt Conveyors

Speaking on the subject "Belt Conveyors—a Challenge to Engineers", H. Von Thaden, vice president, Hewitt-Robins, Inc., presented an enlightening discussion on the progress and prospects of the conveying industry. After summarizing some of the outstanding installations in operation today Mr. Van Thaden turned to the future with numerous suggestions of "food-for-thought" for the material handling engineer. He stressed the need for decreasing the congestion of traffic on city streets. The speaker's proposed solution to an annoying problem right in the vicinity of the Statler Hotel in New York, the subway shuttle train between Times Square and the Grand Central Station, struck the fancy of the audience because of its close proximity. Mr. Von Thaden predicted that within a few years this dirty, uncomfortable shuttle would be replaced by a moving sidewalk that will carry passengers quickly and safety between the two terminals.

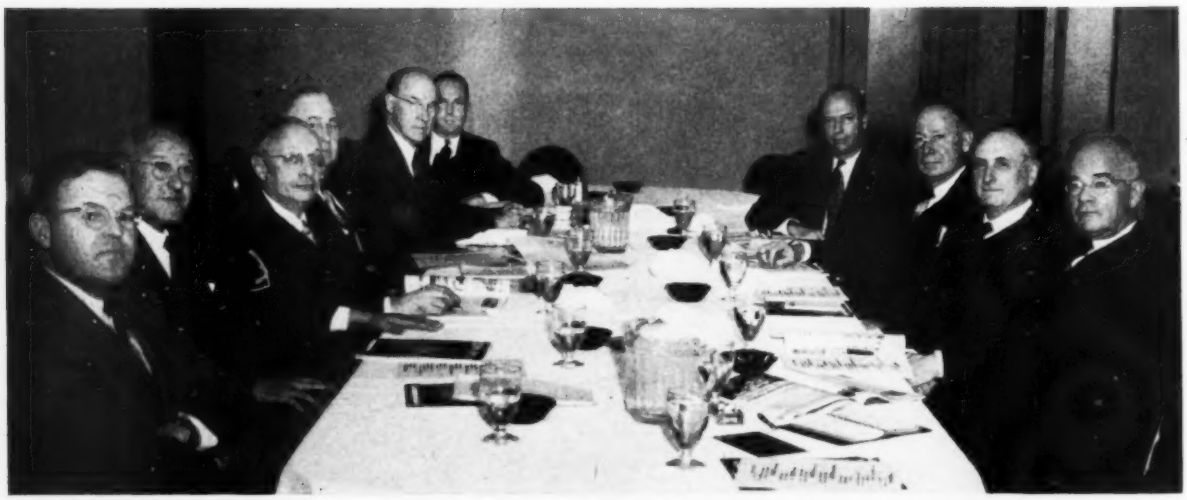
Along the same line would be the elimination of the movement of materials over already crowded city streets and the turning of sidewalks into unloading platforms. One remedy, according to Mr. Von Thaden, is to transport such materials over a public conveyor system, suspended overhead or running underground.

Gas Turbines

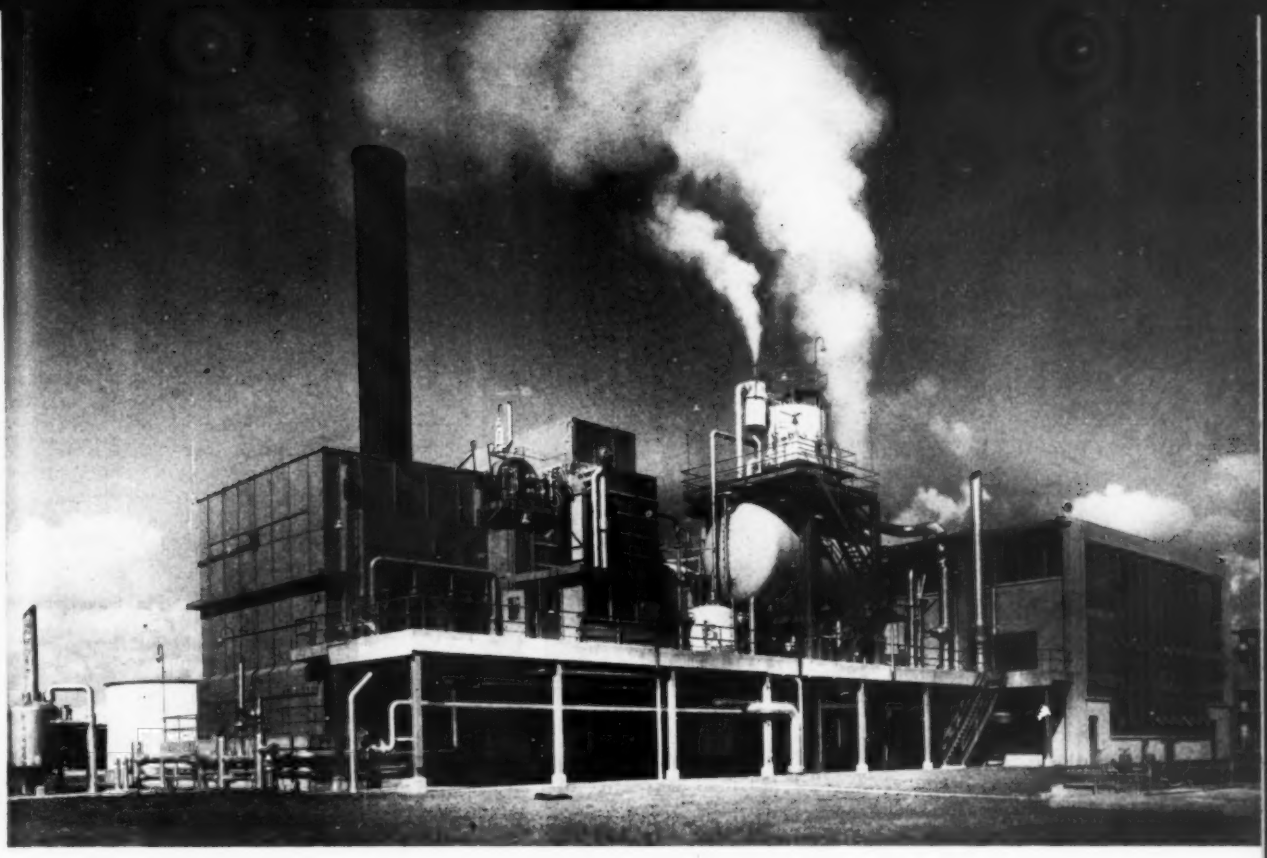
Following the pattern of ASME meetings of the past few years, the topic of gas power plants for locomotives took its place in the spotlight.

(Continued on page 124)

Industry and Power's Editorial Advisory Board Meets in N. Y.



Members of Industry and Power's editorial advisory board take time out from their discussions of current industrial, power, and plant engineering topics to "watch the birdie"—said birdie being wielded by W. E. Poole, associate editor. Left to right: *DON HARWAY*, Los Angeles representative, Industry and Power; *C. L. SEAMAN*, vice president, Industry and Power; *E. J. KATES*, consulting engineer; *H. E. HOLLENSBE*, editor; *A. G. CHRISTIE*, emeritus professor, Johns Hopkins University; *O. D. YOUNG*, Philadelphia representative, Industry and Power; *G. W. KELSEY*, vice president, Builders Iron Foundry; *D. M. DeBARD*, vice president, Stone & Webster Service Corp.; *A. A. POTTER*, dean of engineering, Purdue University; and *WILLIAM STANIER*, consulting engineer.



TWO-MAN SHIFTS OPERATE BLUEBONNET POWER PLANT

This new Corn Products' plant is served by a 250,000 lb per hr boiler and 7500 kw turbine-generator installed in "outdoor" power plant. Food processing buildings will be virtually wall-less to minimize dust hazard, and Diesel driven fire pump will provide added protection.

E. P. WILSON, Consultant,
The H. K. Ferguson Company, Inc.

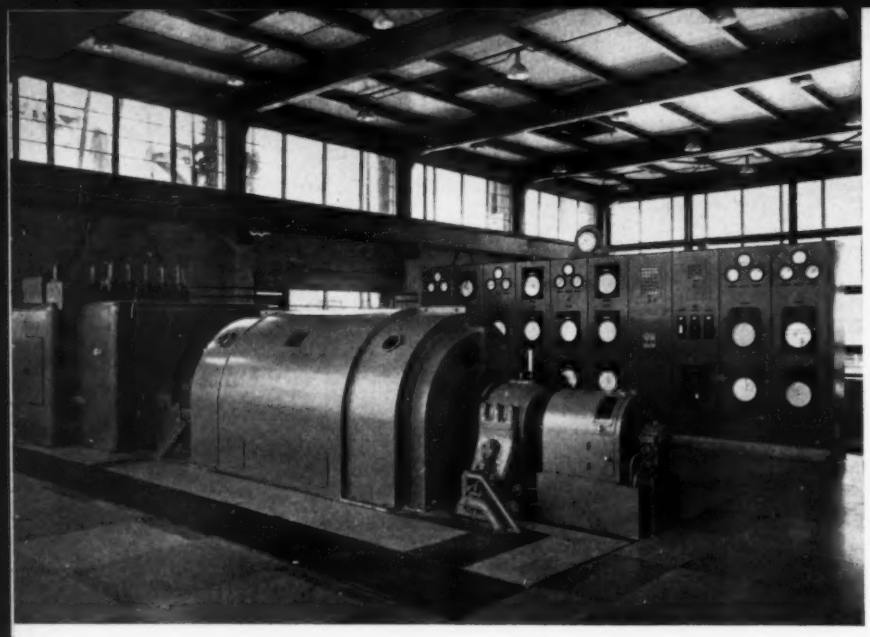
WHEN the Corn Products Refining Company's new Bluebonnet plant at Corpus Christi, Texas, went into operation recently, one 250,000 lb per hr boiler and one 7500 kw extraction type turbine-generator were ready to serve this modern manufacturing unit. The plant is situated on a 150 acre site and is designed with the idea of future expansion. Each building or facility has been constructed so that additional floor space or equipment can be provided with the minimum of outlay and without interruption of manufacturing. The present facilities have the capacity to take care of a daily grind of 20,000 bushels of milo maize grain, but additional manufacturing capacity will eventually require more steam and power.

Both steam and power generation are predicted on the basis of having only two men per shift. All turbine, boiler, and electrical controls, as well as the firing aisle and turbines, are at the same elevation (elevation 45) on a continuous floor slab so that operators do not need to go up and downstairs under normal operating conditions. The turbine is non-condensing, the generator air cooled, and the exciter direct connected. Pumps, vacuum units, and air compressors are at ground level and are serviced by the oiler.

This plant, which is one of four similar plants of the Corn Products Refining Company in the United States, is fully equipped with automatic controls and instrumentation. It is the first of the company's plants to be so designed, and management anticipates that a great advantage will result both in continuity of operation and improvement in quality control.

In the operation of the power plant, an approximate balance is being maintained between the electric power generated and the steam (150 lb and 10

(Top of page) Mild climate of Corpus Christi lent itself well to an outdoor constructed boiler "house". Enclosed portion (right) houses turbine.



Every effort was made to assure a high degree of cleanliness in totally enclosed turbine-generator room. Floor is terrazzo in checkerboard design.

lb) for process. However, any overage of steam will come from the 10 lb line and will be vented to the atmosphere after being metered.

When fully completed and landscaped, this will be one of the most beautiful, as well as sanitary, food processing plants in the country. A great deal of attention has been paid not only to the appearance and arrangement of the buildings, but also to the infinite details of building construction. An open or "wall-less" type of construction was adopted for many of the buildings in order to eliminate pockets and corners where dust (always a fire hazard) might collect. In addition, cleaning systems of various kinds have been installed, as dictated by the various processes.

An emergency power supply connection for 1000 kva has been made with the Central Light and Power Company's lines, and a Diesel engine has been provided in the boiler house for driving one of the fire pumps.

Power

Electric power is being generated at 12,000 volts and distributed at that voltage to thirteen sub-stations, each of 1000 kva capacity, which are located advantageously for serving the many buildings. All distribution lines are underground in conduit. Motors operate at 440 volts, this voltage being supplied by 12,000/480 three phase transformers at the sub-stations.

A pipe tunnel, connecting the present feed building and the dextrose sugar building, passes under the generating room and the boiler. It is 13 ft wide and 13 ft 9 in. high and carries vacuum, air, water, steam, and process lines. Many of the lines installed are of sufficient size to serve the future anticipated growth.

Steam is generated by the new boiler at 450 lb gage with a total temperature of 750°. The boiler is 100% water-walled and can generate a maximum of 300,000 lb per hr. It is gas-fired but the six burners, which are mounted in the front of the boiler, are combination fuel oil and gas ring types. All control and indicating instruments are centered on a boiler panel located near the burners.

Forced draft is handled by a motor driven, double inlet fan equipped with inlet vane control. Induced draft is provided by a double inlet fan (also motor driven) with a damper inlet control.

Preheated air is furnished by a tubular type air heater, which has one pass for air and two passes for gas. A manually operated air by-pass around the heater has been installed for operation at light loads.

Combustion Control

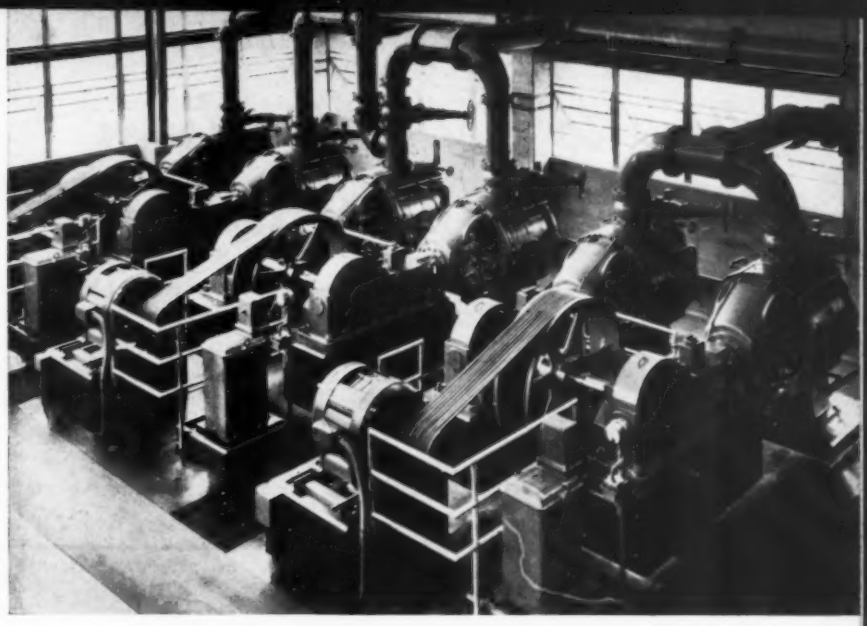
Full automatic combustion control is installed to maintain steam pressure and control air-gas ratio as well as furnace pressure. The system is a pneumatic type, arranged for either manual or automatic control. Provision for manual operation has been made at each combustion control point to insure efficient boiler operation should the control air pressure fail for any reason.

Superheated steam enters the turbine at essentially boiler pressure and temperature. One extraction point is provided from which 150 lb steam is bled for process operations. A pressure reducing and desuperheating station is installed so that when necessary, steam at boiler conditions can be reduced to 150 lb approximately saturated for the process line. This 150 lb steam can be further reduced and fed into a 10 lb process line.

Most of the process steam is utilized in shell and tube heat exchangers, the condensate being returned to the boiler house where it is filtered in three 8 ft diameter filters for reuse in process.

All process evaporators require 10 lb steam and are equipped with surface type condensers. Condenser cooling water is re-circulated through a

Aerial view shows several of the new plant's 21 buildings. Plume of steam and partially obscured stack identify power plant in its central location.



Vacuum necessary for the processing of all food products is supplied by this battery of vacuum pumps, which are also located in a totally enclosed room.

6 cell induced draft type cooling tower. Make-up water for the condenser system is supplied from storage to the cooling tower basin.

Water

Water for the entire plant is purchased from the city on an off-peak basis, with a controlled maximum rate of flow. It is of potable grade and is stored in two large tanks for both process and fire protection systems. A water storage tank for the sprinkler system is located in the grain cleaning building. This tank automatically maintains a pressure of about 65 lb on the fire protection system.

Water for boiler feed passes through a zeolite softener, is heated and deaerated, and stored in the latter condition. Both heater and hot water storage are of sufficient size to take care of the three boilers of the final plant. Two boilerfeed pumps, one turbine driven and one motor driven, have been provided to supply the boiler from the hot water storage. An automatic control maintains boiler level.

Some condensate is available and this has preference over the city water in supplying the feedwater heater and deaerator. A continuous blowdown system is employed, the blowdown being put through a flash tank. Water from the flash tank passes through a heat exchanger before being discarded.

For internal water treatment, separate complete systems for chemical feed and phosphate feed are provided. Each system is composed of a dissolving tank, high pressure pump, and control. Feed may be either continuous or charge.

Four 10 ft diameter zeolite softeners are installed, since they will soften, in addition to the treated boiler water, an equal or greater amount of water for process.

Compressed air is produced by two motor driven compressors, one 2000 cfm unit operating at 50 lb discharge pressure, and the other at 100 lb pressure and a capacity of 750 cfm.

Since considerable equipment—such as vacuum filters and evaporator condensers will be operated under 22 in. and 26 in. of mercury — three duplex, motor driven dry vacuum pumps are installed in the generator building. These pumps will furnish the necessary vacuum for process equipment in buildings adjacent to the power plant. In additon, two vacuum pumps of the same size as those in the generator building are installed in the sugar refinery which houses numerous evaporators. The pumping units are located near the refinery's evaporator condensers.

Concrete sunshades, on the feed house, deflect the high glare of the sun and offer protection against infrequent rainstorms.

As the plant is located beyond the city limits, installation of a complete sanitary disposal system has been provided. These facilities consist of a sewage treatment plant and an incinerator for burning plant rubbish. Water for the sanitary system is taken directly from the city mains and through a separate meter ahead of the two large water storage tanks.

Corpus Christi was chosen as the site for the Bluebonnet plant for a variety of reasons but mainly because of: (1) Supply of good city water, which is needed in the preparation of the plant's food products—such as starches, sugars, and syrups; (2) Abundant supply of natural gas for fuel; (3) Availability of milo maize which is grown in great quantities in the area surrounding the plant; and (4) Location on a water front that gives access first to the Intracoastal barge canal and second to ocean-plying vessels.

LIST OF EQUIPMENT

Boiler—The Babcock & Wilcox Co.
Turbine-Generator—Allis Chalmers Mfg. Co.
Burners—The Babcock & Wilcox Co.
Air preheater—The Babcock & Wilcox Co.
ID & FD fans—American Blower Company
Softeners—The Permutit Company
Feedwater treatment pumps—Hills McCanna Co.
Feedwater pumps—Ingersoll Rand
Deaerating feedwater heater—The Permutit Company
Pump motors—The Allis Chalmres Mfg. Co.
Fire pumps—Dayton Dowd Co.
Fire pump turbine drive—Westinghouse Elec. Corp.
Cont. blowdown—Strong, Carlisle & Hammond Co.
Blowdown valves—Yarnall-Waring Co.
Non-return valves—Edward Valves, Inc.
Other valves—The Chapman Valve Mfg. Co.
Cooling tower—Lillie-Hoffman Cooling Towers, Inc.
Combustion control—Republic Flow Meters Company
Flow meters—Brown Instrument Co.
Boiler level control—Republic Flow Meters Company
Boiler meters—Republic Flow Meters Co.
Vacuum pumps—Worthington Pump & Machinery Corp.
Diesel—Detroit Diesel Engine Division, General Motors Corp.
Heat exchangers—Stainless Products, Inc.

How to Get More from SUPERVISOR TRAINING

In cases where supervisory training cannot be evaluated in dollars and cents, managements must rely upon attendance records, participation, and comments from trainees to determine the progress of their programs. These factors — as well as reaction surveys, test groups, and pre-test and after-test examinations — are discussed in detail. A sample survey form is included to assist in arriving at an accurate evaluation.

EDMUND MOTTERSHEAD, Edmund Mottershead Associates, Chicago

TODAY most progressive managements acknowledge the fact that supervisor training programs are doing a good job in industry—particularly in regard to promoting greater worker productivity, improving employe relations, and reducing costs. Nevertheless, just how much good such programs are doing is sometimes difficult to ascertain. The purpose of this discussion is to help industry evaluate the effects of recently completed training courses or to determine the progress of current programs so that proper steps can be made, if necessary, to increase the benefits.

In some instances results can be measured in dollars and cents. For example, in a specific plant (hereafter referred to as plant A) the average cost of replacing a worker is from $200 to $225. This company, which recently applied a special type of training to 145 supervisors in an effort to obtain better cooperation between workers and management, asked their supervisors to report how many times they applied the "method" in one month. The average was 4.6 applications. Hence 667 workers received personal contact from their supervisors within the specified period.

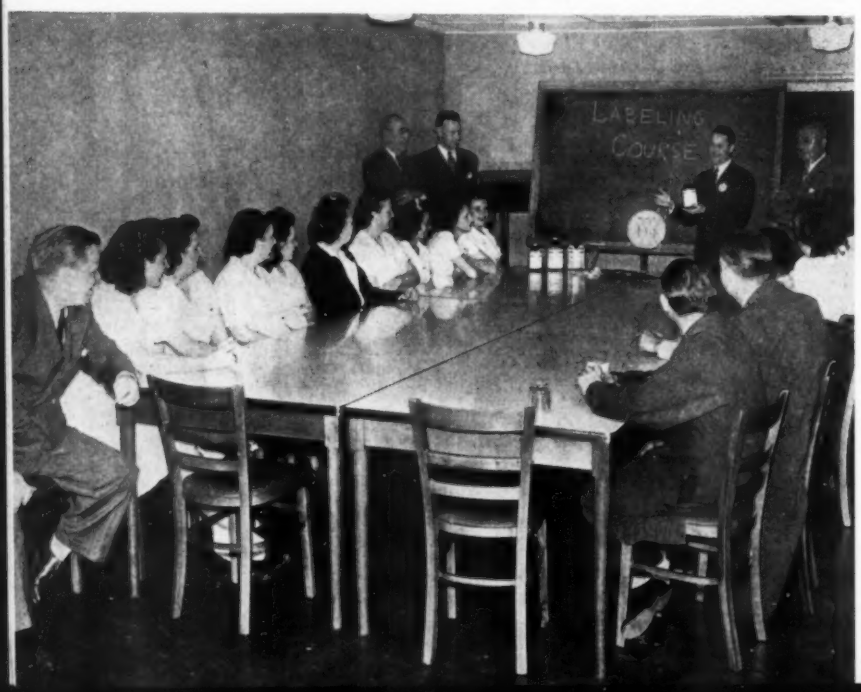
At that time the company's turnover rate was about 10% per month. On this basis 67 workers from the group contacted would be replaced in one month—at a total cost of $13,400. However, the supervisors reported that because of the direct contacts they were able to "salvage" 16 employes on the verge of leaving—a demonstrable saving of approximately $3200.

Fig. 1

Group:	Enrolled:	Average:	People in Group:
A	14	11.6	Mixed, lower level supervisors
B	15	13.8	Mixed, lower level supervisors
C	14	13.2	Mixed, lower level supervisors
D	15	11.8	Mixed, lower level supervisors
E	10	10.	Women, lower level
F	9	7.4	Top level executives
G	11	11.0	Women, lower level
H	12	10.08	Men, lower levels
I	8	6.4	Top level executives
J	9	7.8	Men, lower levels
K	13	11.8	Men, lower levels
L	11	10.1	Men, lower levels

Unfortunately, such clearly-defined monetary benefits as described in the foregoing paragraphs are uncommon. For the most part, the answer for management to the question "how much good does training do?" lies in long-range changes in the organizational picture and in employe attitude and performance. For the immediate purpose of evaluating a training program which has just been undertaken or completed, most companies must rely upon the following factors: (1) attendance records of training programs; (2) participation records of attendants; and (3) comments from supervisors.

Attendance records are evidence of interest on the part of those participating. For instance, 12 groups of supervisors participated in the training at plant A. Over-all attendance for the 145 supervisors was 91.52%; average



Left—Evaluation of training program at Plant A indicated that mixed groups of both men and women at meetings were preferable.

Fig. 2 (right) — Sample survey form used at Plant A.

SUPERVISORY TRAINING EVALUATION

NAME:_____ DATE:_____

DEPARTMENT:_____ POSITION:_____

The purpose of this report is to get specific and detailed reaction from every supervisor who underwent the recent series of training conferences so that the results of such training may be evaluated and future training programs planned to obtain the maximum benefit for the entire organization.

Check the reactions which most nearly fit your own in answering the questions. Do not hesitate to write in detailed explanations wherever you wish.

1. What did you get out of the recent series of 5 conferences on cooperation?

   a. Nothing b. Had a good time. c. Got a few good ideas. d. Got a good workable technique I can use.

   Explain:_____

   _____

2. Would you willingly participate in additional training programs of a similar nature covering other topics, other personnel and management problems?

   a. No. b. If I have to. c. If the other men do. d. Yes. On company time

   e. Yes. On my own time if need be.

   COMMENT:_____

3. Have you made any effort so far to apply the principles developed in the series of conferences?

   a. No. b. One or two. c. Several d. Many, and will continue to use the method.

4. Allowing for vacations and other normal work interruptions, how much time would you feel willing to devote to such meetings as this?

   a. None. b. 1 meeting a week, 5 meeting series, about 2 such series a year. c. 1 meeting a week, 10 to 12 week programs, about 2 such a year. d. 1 meeting a week, every week, with suitable programs.

   e. Two meetings a week, or as often as necessary to get it all in.

5. Considering the needs for additional supervisor training brought out in these conferences, indicate your 1st, 2nd, and 3rd choice for the next type of training to be undertaken.

   _____ Job Instructor Training
   _____ Job Relations Training
   _____ Conference Techniques and Leadership Training
   _____ Conferences on Utilization of manpower
   _____ Public Speaking
   _____ Job Relations Training
   _____ Effective Speaking and Human Relations
   _____ Conferences on Organization
   _____ Conferences on Policy
   _____ Conferences on Grievances
   _____ Conferences on Discipline

attendance per group per meeting was 10.4 persons; 11 persons dropped out or never showed up at all because of business, vacation, health, or other reasons. The breakdown by groups is shown in Fig. 1.

Some space is usually provided on attendance records for "cases brought in" problems discussed, examples of technique explored, comments and questions by each member of the group. These forms indicate to the conference leader or training director the degree of an individual's relative participation in the group. Evidence accumulated in plant A showed that on the average each person asked 4.4 questions per session, made 3.2 comments per session, brought in 1 or more cases, and in the course of 5 sessions put on two demonstrations of the particular technique being developed and studied. However, more than half of the group sat around and said nothing most of the time. In each group two or three individuals did most of the talking, provided most of the problems and discussion. Consequently, detailed examination of the record indicated that only 40%, approximately, of the group got sufficient help from the program to make management feel sure that the technique developed would be put to use.

Comments

Individual comments of supervisors, explaining just what they "got out of the course" of training, are perhaps the most valuable guide to the effectiveness of the training. A group of foremen and supervisors, each with 2 to 25 years experience, have opinions of merit; if they seriously feel that they got some benefit from the program, and specify just what benefit they received, management has a guide to what is being accomplished. At plant A comments were received from about 90 of the 145 supervisors; some of the remarks were:

"I got a workable technique on how to handle people".

"I believe I received assistance in better organizing my thoughts and words in discussions with employes".

"Got a good technique which I can use. Particularly ideas of cooperation between departments".

"I got some good ideas."

"Interesting and instructive".

Of course these comments must be analyzed thoroughly to be of any assistance to management. Obviously the men who reported that they "got some good ideas" probably absorbed much less of the training than the men who said they "received assistance in organizing their thoughts".

Other methods of evaluating the results of supervisor training programs include reaction surveys, the formation of test groups, and tests or examinations on a "pre-test and after-test" basis.

Free Copies of Supervisor's Personal Check-Up Chart

So much interest was exhibited over Mr. Mottershead's November article and supervisor's personal check-up chart that we are making additional copies of the chart available to our readers. If you missed the November article and want to obtain a "bird's eye view" of what your supervisors think of their character and ability as a leader, just drop a line to The Editors, Industry and Power, St. Joseph, Michigan, advising how many charts you need for your plant.

Reaction surveys

Reaction surveys have been found to be useful tools in measuring the effectiveness of training programs. A great deal of information otherwise unobtainable, except in a general way, is thus revealed and a statistical basis for conclusions can be established for presentation to management.

A reaction survey was conducted at plant A during the last half hour of the 5th (final) session of the program. (A sample survey form is shown in Fig. 2). Success of plant A's program is evidenced by the reports of 125 supervisors who completed the training evaluation questionnaire.

On question 1—"What did you get out of the recent conferences?"

44 replied "Got some good ideas"

81 replied "Got a workable technique I can use".

On question 2—"Willingness to participate in additional training"

1 replied "If I have to"

1 replied "If the other men do"

26 replied "yes, on company time"

97 replied "Yes, on my own time"

In general other questions can be formulated for such a questionnaire to bring out whatever information is desired. The important thing to bear in mind is to make sure that the members of the group understand the purpose of the evaluation sheet, and that they know exactly what each item means. Without this understanding accurate information will not be recorded.

Test groups in supervisory training are of primary value in making the training more effective. For instance where one group gets training and another does not may indicate effectiveness of training up to a point, but so many other factors enter into the picture that this is difficult to prove conclusively. Perhaps the supervisors who do not get the training may actually be more efficient at their jobs than the trainees; thus the records would show no appreciable differences.

A test was made at plant A as to the composition of the groups. The attendance record indicated clearly certain facts as to who has the most regular attendance, and why. Results also revealed a preference toward mixed groups of both men and women. Similarly, in this particular program, groups of similar levels of experience and authority were found to be better practice.

Where specific skills—such as skill in instruction, skill in handling a grievance, or specific knowledge concerning management policies—are involved, pre-testing and after-testing of the trainee group is entirely feasible. By these means the gains in knowledge and/or ability can be uncovered.

Pre-test devices also determine in advance how much the group knows. "Find out how much he already knows" has long been stressed in job instruction. Nevertheless the pre-test is frequently overlooked as a basis for comparison.

In summary, before any attempt to evaluate the results of supervisor training can be made, the program must have a single objective. Other factors in the problem must be kept as nearly constant as possible if true measurement is to be obtained.

When to Check

Evaluations of training results should be made frequently, and at regular intervals. Don't wait three years to find out if the program is getting results. Check up at the end of every course, or at the end of each 2 or 3 month period.

Members of any supervisory group have years of experience and a great deal of common sense. They have definite ideas as to how to make discussions more useful to themselves. After all these people are closer to their individual problems than the plant superintendent, personnel director, or the training leader. The trainees want above all something they can take right out into the shop and use. Get them to offer suggestions that will make the training course as useful as possible.

Strength of an industrial organization is unquestionably in its workers; similarly, the strength of the workers lies in the supervisory and executive staff. Constant training is required to keep that supervisory team functioning at its highest possible level of efficiency.

BRYAN, OHIO, ADDS ANOTHER DIESEL AND CHANGES FROM 2 TO 3 PHASE

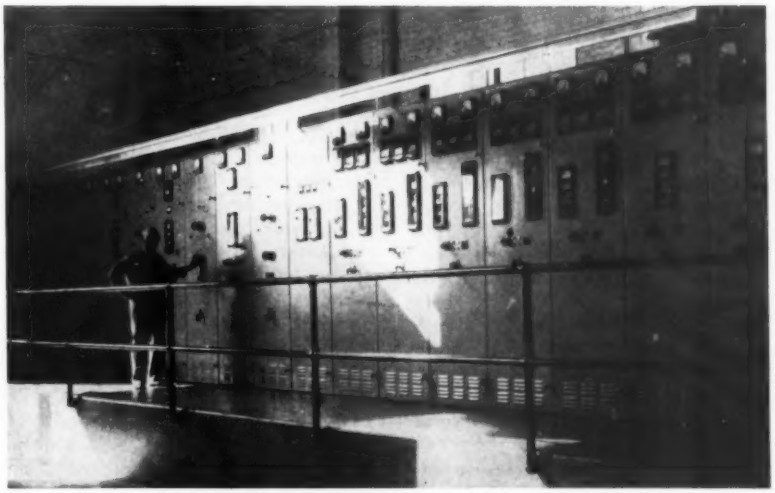
To meet requirements for additional generating capacity, a new 2500 kw Diesel-generator was recently installed in this municipal power plant. Concurrently the city's electrical system was changed over from 2 phase to 3 phase current. Scott-connected transformers were installed for industries which had a large number of 2 phase motors and did not wish to change to 3 phase.

H. T. WILDE, JR., Superintendent of Utilities, Bryan, Ohio

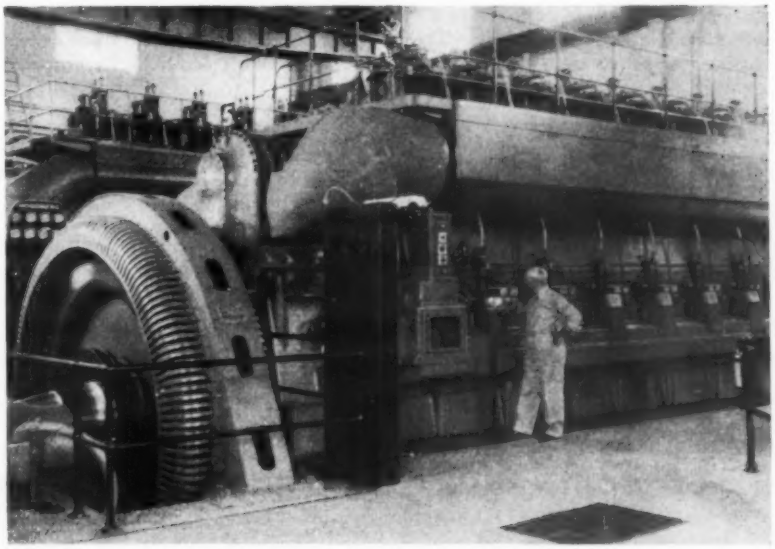
FOR a long time members of the Board of Trustees of Public Affairs, Bryan, Ohio, had hesitated to change the city's 4 wire, 2 phase power station and distribution system to 3 wire, 3 phase. However, when the board was confronted with the problem of purchasing another Diesel engine and generator to meet the increased electrical demands, definite action had to be taken before the order for the new unit could be placed.

After considerable study the decision was reached to make the necessary changes to generate at 3 phase, install a 2500 kw Diesel generator and new switchboard, rewire the entire distribution system for 3 phase, and erect a cooling tower to eliminate the station's open spray ponds.

Although 4 wire, 2 phase power systems were popular a number of years ago, the disadvantages—both to the municipal station and the consumer—of obtaining and operating 2 phase equipment more than offset the cost of making the change to 3 phase at this time.



New generator control and distribution panelboard was installed when station's power generation was changed from 2 to 3 phase.



Although the engine is fully equipped with alarms and automatic controls, operators maintain constant supervision of operation.

Two Cycle

The new Diesel is of the 2 cycle solid injection type, with a 21½ in. bore and a 29 in. stroke, and it operates at 225 rpm. Engine is equipped with air filters in the intakes and silencers on the exhausts. Direct connected to the engine is a 2500 kw, 2300 volt, 60 cycle generator. The shunt wound exciter for the generator —rated 125 volts, 40 kw—is driven at 1150 rpm by V-belts from an extension of the generator shaft.

Fuel Oil

Fuel oil for this plant is trucked 90 miles from a refinery in Toledo, Ohio, and is stored in one 40,000 and one 60,000 underground tanks. The overall plant average is 13 kwh per gal of

fuel oil. However, the newest Diesel produces 13.5 kwh per gal of fuel. Approximately 3000 gal of fuel oil per day are consumed.

Silencer for the new unit contains waste heat coils, and water that is pumped through these coils also passes through heat exchangers for preheating the fuel oil.

From the storage tanks fuel oil is pumped through centrifuges and the heat exchangers to overhead day tanks. All oil from the day storage tanks is metered before it enters the engines. Lube oil is passed continuously through filters to insure maximum lubrication efficiency. An auxiliary lube oil pump, driven through reduction gears by a 20 hp motor, maintains oil pressure on the engine's bearings when the main pump is not in operation.

Cooling Tower

An induced-draft, double-flow cooling tower—19 ft wide by 63 ft long by 25 ft high—has been installed to cool circulating engine jacket water. The tower is designed to handle 3400 gpm and cools incoming water from 101° to 87° with 76° wet bulb temperature. One 3-blade propeller type fan driven by a 40 hp splash proof motor circulates the air through the tower.

Engine jacket water is treated with sodium chromate, and a concentration of 75-100 gr per gal at a pH of 8.5 is maintained. Raw water in the cooling tower is also treated chemically to reduce scale formation.

Both jobs of changing the distribution lines and installing the new Diesel were carried on simultaneously over a period of a year. Consequently, as soon as the new engine was ready, it was placed in operation through the new switchboard and feeders. The existing generators were connected to the 2 phase side of Scott-connected transformers and operated with the new unit. Then one by one the generators were removed from service and rewound for 3 phase right on the job. At the same time the auxiliary equipment for each generator set was either rewound or new units were installed.

Altogether the Bryan plant now has four Diesel engines. Two units, installed in 1930, are rated at 1500 hp and have air injection. The third engine, a 2 cycle 6 cylinder unit equipped with hydraulic lifts on the fuel inlet valves, is rated at 2250 kw and was installed in 1940. The fourth and newest unit was placed on the line in March 1948.

Alarms

Engines are equipped with complete alarm systems to detect any derangement of pressure or temperature. Also, pyrometers are installed to provide a visual check of exhaust temperatures.

Normally the new 2500 kw Diesel plus a smaller unit are operated during the peak loads. But from midnight to 5 a.m. one of the small units is able to carry the load.

Plant subsoil is exceptionally good at this location and no special equipment was needed for vibration control.

Color

All piping is painted in a color code for ease of identification, but in addition the colors have enlivened the whole plant especially in the basement areas. The color code adopted is as follows:

Yellow — lube oil, Green — jacket water, Gray — well water, Red — fuel oil, and Orange — electrical conduits.

All maintenance work on the engines is performed by the plant's own crew, an exceptionally well equipped shop providing every facility.

Projects that are in process or planned for the immediate future include: installation of new silencers and air intakes on #1 and #2 engines, removal of a 125 ft radial brick chimney, and sandblasting of the building exterior.

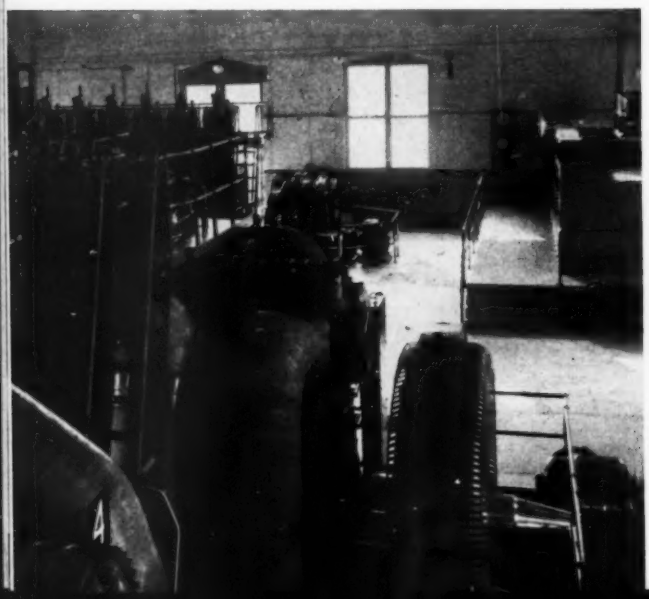
This municipal plant was originally built as a steam plant in 1896 but all the steam equipment has been removed and the plant converted to Diesel power. The only indication that this station was once a steam plant is the brick stack but this, too, will soon be removed.

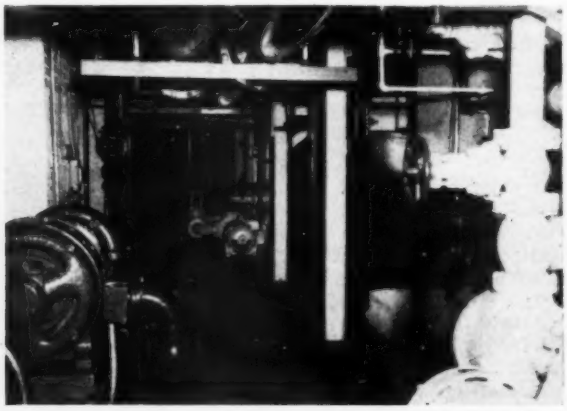
Load

If the electrical load continues to grow as it has in the past, another 2500 kw Diesel generator will be needed by 1953. Space is available for another engine generator and all changes in connection with the installation of the latest engine were made with the idea in mind that a fifth Diesel would be installed some time. As additional generating capacity is needed, the smaller engines will be removed and larger units installed.

LIST OF PRINCIPAL EQUIPMENT

Diesel engine—Nordberg Mfg. Co.
Generator—Allis-Chalmers Mfg. Co.
Switchboard—General Electric Co.
Cooling tower—The Marley Company
Oil centrifuges—DeLaval Separator Company
Lube oil purifier—Honan-Crane Corp.
Raw water treatment—Oakite Products, Inc.
Silencer—The Maxim Silencer Co.
Governor—Woodward Governor Co.
Engine fuel pumps—American Bosch Corporation
Air filters—American Air Filter Co.
Valves—Crane Co.
Controls—Viking Instrument, Inc.
Fuel filters—Wm. W. Nugent and Co.
Fuel meter—Buffalo Meter Co.
Heat Exchangers—Schutte and Koerting Co., Griscom-Russell Co.
Exhaust pyrometers—Illinois Testing Laboratories, Inc.
Alarms—Viking Instruments, Inc.
Crankcase oil—The Texas Co.
Cylinder lube oil—Standard Oil of Ohio





Above — Arrangement of pipe lines, pumps, and other auxiliaries in basement permit easy access for maintenance. Left — General view of station from spare parts balcony.

CALCIUM & MG IN WATER DETERMINED SEPARATELY BY NEW METHOD

Procedure described by the authors is said to be the first rapid method for the separate determination of calcium and magnesium in water samples. It is based on colorimetric titration and is expected to become standard practice in power plant water treatment.

A. O. WALKER, Ph.D., and

R. S. ROBERTSON, National Aluminate Corporation

PROPER control of almost all modern industrial water treating processes requires accurate and rapid methods for the determination of calcium and magnesium. Gravimetric analysis, although still frequently employed as a "referee" method, is not practical for such control purposes, because it is too time-consuming and requires extremely careful technique. Titration with standard soap solution was a great improvement, as this method was quicker.

In 1945 the application of amino polycarboxylic acids for determining the content of such metals as calcium and magnesium in solution was shown by Schwarzenbach, Biedermann, and Bangerter; (1) in 1947 by Schwarzenbach and Ackermann; (2) and in 1948 by Schwarzenbach and Biedermann. (3)

Schwarzenbach's method, employing disodium dihydrogen ethylenediamine tetra-acetate for the determination of hardness in water, was adopted by H. Diehl of Iowa State College (4). Diehl's method, as revised, is more reliable than the soap test and has the additional advantages of rapidity and simplicity. Others also show the accuracy of such procedures (5).

TABLE II

Raw Waters from Various Locations

All results in ppm as $CaCO_3$ — Run on 50 ml of solution

No.	Gravimetric		Tetraacetate	
	Total Hardness	Mg Hardness	Total Hardness	Mg Hardness
1	134	45	132	44
2	486	277	494	270
3	486	168	465	169
4	308	101	311	104
5	427	144	425	147
6*	470	202	445	198

* 5.0 ppm ($NaPO_3$)6 present.

This method is based on the property of the disodium dihydrogen ethylenediamine tetraacetate to form soluble complex ions with calcium and magnesium. The indicator, termed CuVer, is red in the presence of magnesium and blue in its absence. Using a solution of the tetra-acetate as a titrating reagent, first the calcium and then the magnesium will react, the dye changing color when the last of the magnesium has been titrated. The titration must be performed under controlled conditions, and pH, the most important factor, must be approximately 10.0 to give the desired results.

But this method did not differentiate between calcium and magnesium contents and determined only their sum.

Precipitating calcium as calcium oxalate and then performing a titration for the magnesium only (the difference between the total hardness and the magnesium hardness giving the calcium content) was one method suggested for obtaining the calcium and magnesium separately. However, on titrating, the calcium oxalate would partially react with the tetraacetate solution. Removing calcium oxalate by filtration produces satisfactory results but requires more time than the soap titration.

Since the reaction of calcium oxalate with the tetraacetate was much slower than that of the soluble hardness, the authors reasoned that a rapid titration—under properly controlled conditions, to the first indication of an endpoint—should give an accurate measure of the magnesium content in waters where the calcium oxalate was not removed. Experimental data and information on the method developed are given in the following.

TABLE I

Standard Waters

(Waters prepared from distilled water and gravimetrically analyzed standard solutions of calcium chloride and magnesium sulfate)

All results in ppm as $CaCO_3$ — Run on 50 ml of solution

Ca present	Mg present	Adjustments	Mg found using tetraacetate
68	170	—	164
68	68	—	70
68	34	—	34
68	2	—	2
7	3	—	8
7	3	Added 50 ppm Ca	3
14	7		15
14	7	Added 50 ppm Ca	7
14	7	Added 25 ppm Ca	7
14	7	Added 12 ppm Ca	7
14	7	Added 6 ppm Ca	8
14	7	Added 140 ppm Ca	7
50	17		16

Reagents

1—Standard solution of disodium dihydrogen ethylenediamine tetraacetate:

Weigh out 4.0 grams of the tetraacetate; dissolve in 900 ml of water; add 0.10 grams of magnesium chlo-

TABLE III

Lime-Soda Ash Treated Water and Boiler Waters

Gravimetrically analyzed standards added
All results in ppm as $CaCO_3$ — Run on 50 ml of solution

No.	Type of Water	Original Total Hardness	Original Magnesium	Calcium Added	Magnesium Added	Magnesium Found
1	Phosphate softener effluent	1	trace	50	0	trace
1	—	—	—	50	17	17
1	—	—	—	50	9	8
1	—	—	—	50	4	4
1	—	—	—	50	34	34
22	Boiler internally treated	9	trace	50	0	trace
2	—	—	—	50	51	52
3	Boiler externally treated	1	trace	50	0	trace
3	—	—	—	50	17	19
3	—	—	—	50	34	34
3	—	—	—	50	51	52

ride; and adjust the solution so that 1 ml=1 mg of $CaCo_3$.

2—Buffer solution:

Mix 67.0 grams of pure ammonium chloride, 570.0 ml of pure concentrated ammonium hydroxide, 23 ml of reagent grade ammonium sulfide. Dilute to one liter.

3—Indicator solution:

Dissolve 5 grams of dry CuVer powder in 100 ml of methyl alcohol.

4—Saturated solution of sodium oxalate.

5—Calcium Chloride solution:

Dissolve 2.78 grams reagent grade $CaCl_2$, anhydrous, in 1 liter distilled water.

Procedure

Total Hardness:

1—Take 50 ml of clear water to be tested and place in a 250 ml flask to allow for sufficient agitation.

2—Add 1 ml of buffer solution and mix. Add 4 drops of indicator, and titrate with standardized tetraacetate solution until the red color is just discharged. The end-point is indicated by the discharge of all the reddish coloration regardless of the final color of the indicator.

3—The number of milliliters of tetraacetate used, multiplied by 20, equals the parts per million of total hardness as calcium carbonate.

Magnesium Hardness:

1—Take 50 ml of the clear water to be tested and place in a 250 ml flask. Water should be 20° C or higher.

2—Add 1 ml of buffer solution and 5 ml of oxalate solution. Allow to stand with occasional mixing for 5 minutes.

3—Add 5 drops of indicator and titrate rapidly with tetraacetate solution, agitating thoroughly throughout the titration. Take the first disappearance of red color as the endpoint.

Avoid titrations above 10 ml, because of the increased opportunity for calcium oxalate to react during the process. If the calcium content of the water is less than 50 parts per million, one ml of the calcium chloride solution must be added before adding any other reagents. This decreases the time necessary for complete precipitation of the calcium.

The red color will return, on standing, due to the delayed reaction of the precipitated calcium. However, sufficient time is available to make an accurate titration of magnesium before this occurs.

To allow for solubility of calcium oxalate, subtract 0.1 ml from the burette reading. The corrected reading multiplied by 20 gives the parts per million of magnesium present as calcium carbonate. The calcium content can then be obtained by difference.

Interference

Interfering ions for magnesium determination: No interference was noted by concentrations of ions as shown in Table IV. Manganese and copper offer the greatest difficulty. Their presence in interfering quantities, however, can be detected by the fading of the dye, a yellow-brown to a red-brown coloration being produced. The addition of a product, called ManVer, with waters having 10 ppm of manganese reduces the interference to a negligible amount. But the endpoint with this indicator is not so sharp.

All polyphosphates (with the exception of tripolyphosphate) in concentrations greater than 5.0 ppm prevented the complete precipitation of calcium oxalate and therefore high values were obtained. Amounts of tripolyphosphate up to 100 ppm showed no effect. Heating near boiling for 15 minutes after addition of the oxalate prevented this interference.

Known amounts of ions were added to natural waters to determine interferences.

Discussion

Results on waters were reproducible to 0.1 ml of titrating solution.

Extreme reactivity of the tetraacetate with calcium and magnesium leads to its reaction with insoluble and colloidal particles of hardness; therefore, in titrating for calcium and magnesium, the samples should be free of such particles. A reappearance of the red color at the total hardness endpoint is indicative of insoluble hardness.

Studies of effect of pH on the titration indicates that the pH must be approximately 10.0. Waters with extreme acidity should be adjusted with sodium hydroxide before adding buffer solution. Adding as much as 50 ml of the titrating solution did not change the pH appreciably.

Temperatures below 20° C retard the precipitation of calcium oxalate; a five minute period is then not long enough. For this reason low temperatures must be avoided.

Buffer solution remained stable for a period of six months, the period of the tests. The indicator was found to lose some of its sensitivity on long exposure to air and should therefore be kept in a tightly stoppered bottle.

For the most part other buffers tried were unsatisfactory, due to their encouragement of the co-precipitation of magnesium.

Experimenters found that the calci-

(Continued on page 128)

TABLE IV

Interferences

Ions	ppm Limit Tested Without Appreciable Error
Manganese (Mn^{++})	1
Copper (Cu^{++})	10
Iron (Fe^{++})	10
Iron (Fe^{+++})	20
Lead (Pb^{++})	10
Aluminum (Al^{+++})	10
Zinc (Zn^{++})	20
Phosphate (PO_4^{---})	100
Sulfite (SO_3^{--})	1000
Nitrate (NO_3^{-})	1000
Chromate (CrO_4^{--})	2000
Carbonate (CO_3^{--})	2000
Sulfate (SO_4^{--})	5000
Chloride (Cl^{-})	5000
Chestnut Tannin	300
Lignin Type A	300
Lignin Type B	300

FORK TRUCK-PALLET SYSTEM IS MONEY-MAKER FOR WHITNEY BLAKE

Since this company's first fork truck and pallets were installed during the war, additional units have been added to accommodate the increase in production. Continuous material flow — made possible by the trucks — has resulted in substantial savings both in time and labor.

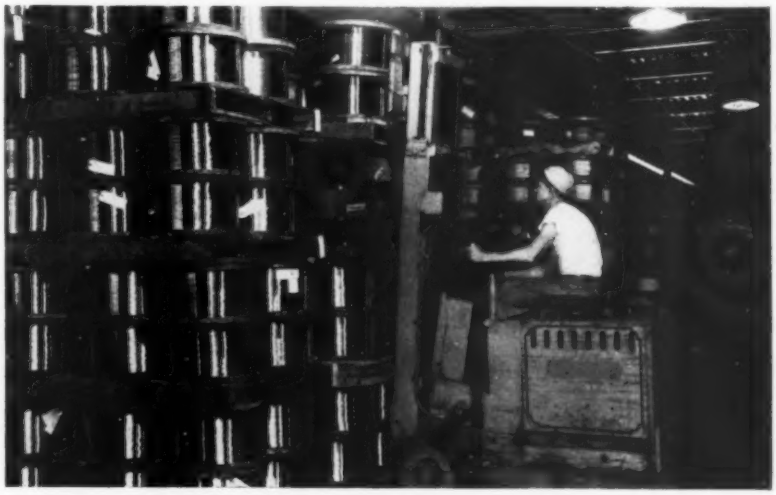
D. C. McKEAN,
Purchasing Agent, The Whitney Blake Company

WHEN The Whitney Blake Company of Hamden, Conn.—manufacturers of shielded cables for electronic devices, drop wires, portable cords, and other electrical wire products—adopted their fork truck-pallet system in 1944, consideration was given to the five fundamental steps of material flow: receiving, raw material storage, manufacturing, finished product storage, and shipping. Layout of the Whitney Blake plant was such that maximum handling efficiency could be obtained through each step and that the flow of materials could be maintained in almost a straight line.

Over the past few years additional fork trucks and pallets have been added to accommodate the increase in production, but no basic changes in material flow have been necessary. Today a fleet of four 2000 lb battery-powered trucks are in operation. As a result, substantial savings have been realized both in time and labor.

Material used in the manufacture of the company's line of wire products arrives in box-cars or trailer trucks. Insofar as possible all material is placed on double-faced wooden pallets, which are standardized at 48 in. x 48 in. in size. Reels of copper wire (each weigh about 250 lb) are placed eight to a pallet, and pallets are tiered three or four high in the raw material storage area. Drums of dry items—such as waxes or fillers used in the manufacture of electrical insulation—also are palletized and stored three-high. Drums of varnishes, lacquers and other liquids are likewise palletized and tiered several high. Sacked or bagged material is made into unit loads of from twenty to thirty items, interlocked to prevent shifting or slipping. Bales of rubber, natural or synthetic, are palletized and handled by the trucks from receipt, into

1 *Incoming bagged material is manually stacked into unit loads and moved by lift trucks to storage.*



2 *Procurement of raw material for production lines takes but a few minutes at the Whitney Blake plant.*

WANTED - An Assistant Editor

Because Industry and Power is expanding editorially, opportunities with exceptional prospects are being offered to a qualified man who would like interesting, permanent editorial work combining both field and office assignments.

The person sought does not have to be a "writer", but he should have an industrial and engineering background. The "ideal" applicant would be a graduate engineer with experience as plant engineer or executive of similar duties, preferably in his thirties.

If you are editorially inclined, or looking to the future and planning a change—or if you know someone capable of handling this position—write the Editor, Industry and Power, St. Joseph, Michigan.

3 *Fork trucks are also utilized to transport goods-in-process from one production department to another.*

4 *Finished coils of wire, as well as products in cartons, are palletized and stacked in shipping department.*

storage, and finally into production.

Fork-trucks operate within the cars whenever possible. Safety dock plates bridge the area between the receiving room floor and the freight cars or trailers. In the storage areas overhead safety guards mounted on the trucks are utilized to protect the operators from possibility of toppling loads when tiering to extreme heights.

Within the receiving and raw material storage rooms fork trucks operate some nine hours a day, but in the production area of the plant they work two shifts, or approximately 16 hours.

Goods-in-process are transported intra-plant, department to department, by the fork trucks. For instance, reels of insulated wire are moved from production line to the test department, three at a time, by sliding the truck's forks on each side of the reels which are on edge. Following the test, the reels are moved in the same manner to other departments for the balance of the manufacturing process.

Coils and reels of finished wire are moved into finished product storage and the shipping department on pallets. Eighteen small-sized reels are made into a single load, while coils of wire are moved on pallets some 50 at a time. Out-bound products, which have been placed in small cartons, are palletized in unit loads of from 90 to 100 in the packing department and then moved to the shipping area where they are placed in racks. These racks accommodate three pallets vertically and are placed back-to-back between aisles. Instant requisition is possible when shipments are made up. Inventory also has been simplified through use of the racks of pallets, and also through palletization of raw materials, goods in process and storage.

Service

Once a month all trucks are withdrawn from service for short intervals for greasing, inspection, and check-up. Consequently, operating costs and maintenance have been held to the minimum. Storage batteries and spares (one for each truck) also receive periodical servicing. Batteries are changed at a waist-high rack and trucks are out of service for only five minutes when battery replacement is made.

Straight-line material flow from one end of the plant to the other has prevented congestion of traffic. Under the present layout broad aisles are attainable. Bays off the main traffic aisles are used as temporary, or hold-storage, areas for work-in-process or for supplies that are in constant demand and must be immediately available.

INDUSTRY SPONSORED PLAN DEVELOPS FUTURE EXECUTIVES AND ENGINEERS

According to the thinking of many national leaders in industry and business a better understanding of free enterprise can be obtained when youngsters — the future executives — operate their own business and industrial concerns. As a consequence the Junior Achievement program was developed and is now endorsed by thousands of business leaders.

EARL O. SHREVE
President, Junior Achievement, Inc.

SPONSORED and supported by many of the nation's leaders in industry and business, a plan now in operation gives American young people a practical introduction to free enterprise. The plan, Junior Achievement, provides the youngsters with a working knowledge of our economic system, as well as actual business and industrial experience, and develops good prospects for future executives and engineers.

Thousands of young Americans will become, during the next year, stockholders, workers, managers, and directors of hundreds of new business enterprises. They will form their own companies, raise their own capital through the sale of stock, elect their own officers, design their own products, layout their own production lines, manufacture, and sell their products.

They will follow the same pattern of corporate business practice that guides General Motors, U. S. Steel, and General Electric. But the success of these little companies will be measured in terms of knowledge of the American free enterprise system gained under the achievement program, which teaches the youth fundamentals of business and industry by permitting them to operate going concerns of their own.

Founding

Twenty-three years ago the late Horace A. Moses, former chairman of the Strathmore Paper Company, founded Junior Achievement as a non-profit, non-political, non-partisan, and non-sectarian organization dedicated to the purpose of educating boys and girls (between the ages of 15 and 21) in the ways and methods of American industry.

Eight or more youngsters can set up a JA company. First they must acquire a sponsor, usually a local business, industry, bank, labor union, service club, radio station, or civic organization. Then they must obtain three adult advisers who will devote at least one night a week on counseling the youngsters on: (1) organization, financing, and banking; (2) design, materials, production, and assembly; and (3) merchandising, advertising, and sales. The advisers are volunteers living and working in the same community.

Capital

To raise capital for the new companies stock is sold—at par values of 50 cents a share—to parents, neighbors, and local businessmen. Each company member must own one share (but he cannot hold more than five shares) of stock in the enterprise. Capitalization of the junior concerns range from $50 to $250.

In areas where such junior organizations are in operation, boards of directors (composed of industrial, business, civic, education, and labor leaders) are set up. These boards function in cooperation with local executive directors, who are paid members of the national junior achievement staff and responsible to the national executive director.

Junior programs in each community, where the plan is established, are in charge of local committees which are also composed of business and professional leaders. Such committees secure sponsors and advisers and supervise the business center in which the junior groups meet. Com-

United States Chamber of Commerce award for sponsoring J. A. I. is presented to Charles R. Hook (center) by Earl O. Shreve (left). Robert L. Lund (right) is a past president of J.A.

mitteemen also help to obtain the young people who become members for the various companies.

Group advisers are impressed by the sincerity, ingenuity, and sometimes amazing business acumen displayed by the junior achievers. For example, a steel production man, who is an adviser to a Pittsburgh unit, maintains that he picked up a few new angles on plant management and production from his younger associates, and these ideas have helped him solve some of his own problems.

Types of businesses operated by the junior groups include the manufacture and sale of products made of wood, metal, plastics, cork, leather, and chemicals; handcraft items such as needlework, silk screen, greeting cards, sewing, and clay modeling; and journalism, radio-broadcasting, advertising, photography, job printing, typing, mimeographing, opinion survey, entertainment, and similar services.

Young people, participating in these miniature companies, sincerely appreciate what has been done for them through the sponsoring companies and by the expert advisers supplied by the sponsors. In practically all cases, this appreciation is more than adequate reward for the time and attention devoted by the adults to this work. In fact experience has demonstrated that any business or industrial leader of today who gives of his time and interest to this cause will earn not only the undying gratitude of these leaders of tomorrow but also the great satisfaction of helping promising youngsters get a proper start.

Actual testimony of junior achievers who have served their period of industrial apprenticeship place particular emphasis upon the following: (1) a clear understanding of business and industrial management principles, (2) departmental coordination between engineering, production, and sales, (3) vital importance of product advertising, (4) a genuine understanding of economics, (5) vocational aptitudes and adult employability, and (6) what it takes to design, plan, and produce so as to make a profit.

Two-way Benefits

Individual advisers who have contributed to the development and operation of junior companies testify that many benefits have accrued to the sponsors themselves. In addition to the perfectly natural personal interest in the young people, sponsorship has contributed also to the development of greatly improved local public relations. Such relations have been found to be most improved and effective in the communities in which industrial workers and office employes reside. The young people have carried correct knowledge of the business principles upon which private enterprise is founded right into their homes. This has resulted in a wider and a better understanding of the ethics and creeds of management in our industrial life.

In a sense junior achievement businesses are schools that young people attend without compulsion, without truant officers, without principals, and without faculties. But, sustained through the interest of the youngsters and backed by the community participation, these "schools" have classrooms in which the students select their own projects, design their own tools, choose their own leadership, and develop their own activities.

Since they set up and conduct miniature business and manufacturing establishments, the young achievers come fact to face, with the problems of: labor-management cooperation; operating a business for a profit; creating consumer good-will and demand; fulfilling obligations to stockholders and to the general public; and, of course, developing and producing quality goods in quantity. The youngsters soon find out that their products must sell and bring in more money with which more products can be produced.

In addition to the practical business training, two important and lasting developments are coming out of this junior program. The participants are learning to accept a responsibility and to share work-loads. Also they are obtaining a basic understanding of the operations and benefits of the free enterprises system.

Junior achievement can well be a means for assuring that young Americans become capable business executives, good workers, and intelligent citizens when they get out on their own. As friends, they work out their own labor-management relations (each has turns as managers as well as workers) and develop sound opinions on this highly important phase of business and industry. The youngsters of course always have the help and advice of mature business and industrial experts on all controversial subjects.

Obligations

When the juniors sell shares of stock in their companies, they are not slow in understanding that, both as management and labor, they have an obligation to produce. They realize that friends and neighbors have put money into their endeavors and consequently these stockholders deserve and expect a profit. At the conclusion of the junior business operations (companies can not operate longer than one year), the young people usually have the satisfaction that comes from successful accomplishment and from good human relationship.

Thrift training inherent in the achievement program promises a new generation of Americans schooled in wise and prudent handling of money, personal savings, business finance, and government spending. The implications are obvious: the more youth trained under the program, the greater the thrift potential of the nation. And the more money saved, the greater the amounts invested in free enterprise to insure more jobs, more goods, and more trade. In the opinion of many, the junior achievement program holds the promise of the future for free enterprise and capitalistic democratic government.

Production moves full speed ahead as this junior achiever drills holes in plastic blocks, one step in the manufacture of salt and pepper shakers.

MID-CENTURY REVIEW-FORECAST FORUM HELD BY WESTINGHOUSE

In one-day meet magazine editors are brought up-to-date on significant developments since 1900. Managers of manufacturing divisions supply detailed information and forecast data on steam turbines, a-c generators, switchgear, transformers, motors, controls, lighting, electronic devices, and research.

DESCRIBED as "the most talked to and most walked about" group ever to visit the East Pittsburgh plant of the Westinghouse Electric Corporation, some 54 editors and representatives of technical and trade magazines, who attended a recent Westinghouse mid-century review and forecast forum, were glad to relax at the Pittsburgh Athletic Club, following their "marathon", and hear President Gwilym A. Price and other top company officials discuss informally current conditions and the probabilities of the near future. During the day ten papers on major topics were briefed, and conducted tours took the scribes through experimental laboratories as well as the company's extensive engineering and research departments.

A. C. Monteith made the introductory and closing remarks of the forum and was in general charge of the group throughout the day. At the opening session Dr. Monteith said the forum was being held to take stock of engineering progress and take a sight on the future.

Steam Power

The first formal paper, prepared by D. W. R. Morgan, vice president, South Philadelphia Works, sketched the development of the steam turbine in this country from 1900, when the first central station turbine began operation, until the present time. This discussion covered early turbine installations, exhaust flow problems, cross-compounding, blading, feedwater heating cycle, impulse-reaction developments, blade evolution, improved metals, governors, valves, mechanism, and condensers.

Future developments were expected by the author to be along the lines of higher steam temperatures (with some pause at the 1050 degree level); turbines of greater capacity, with turbine-generators of 150,000 to 200,000 kw likely to be in demand; greater application of the reheat principle; increased standardization of turbines; and possible utilization of atomic power. Within the next ten or a dozen years, Mr. Morgan expects that installed generating capacity will be doubled and tripled or quadrupled within the remainder of the century.

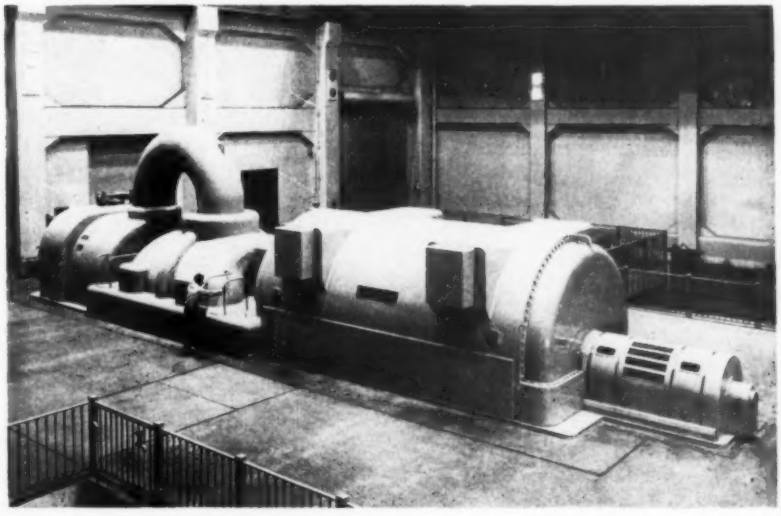
Also, if research developments and the economic situation permit, the future holds promise of turbines built for 1200 degrees and 3206 psi and having 40% thermal efficiency. In building such a super-turbine, Mr. Morgan believed the front end would be the critical one and steam brought through a series of small inlet pipes, which would feed nozzle chambers (separately cast of some metal, now unknown) that could stand such high pressure at high temperature. He did not expect the exhaust end to interfere with building a 240,000 kw unit even at 3600 rpm for these extremes of 1200 degree, 3200 lb. If turbines larger than 300,000 kw become economically justifiable, the obvious step would be to go to cross compounding with an 1800 rpm low pressure element; then units delivering 500,000 kw would become possible.

Mr. Morgan believed the immediate task with the gas turbine is to develop it for long continuous operation at gas temperatures beyond 1300 degress and to obtain information that will lead to construction suitable for temperatures up to 1500 degrees. Such long life machines are expected to become realities, and open-cycle types of capacities up to 10,000 kw will be built in a few years. Closed cycles offer possibilities of machines several times this rating.

A-C Generation

Generation of electric power was the topic discussed by C. M. Laffoon, manager, A-C Generator Engineering department, who described the early conflicts between d-c and a-c advocates, as well as the uncertainties relative to frequencies and the type of prime mover. The historical part of this paper also discussed insulation, stator conductors, stator iron, ventilation, hydrogen cooling, rotor design and construction, turbine speed, windings, vibrations in two-pole generators, exciters, waterwheel generators, and thrust bearings.

As to the future, Mr. Laffoon al o anticipated that 3600 rpm, 250,000 kw, single shaft units can be built as soon as they are needed. The greatest possi-



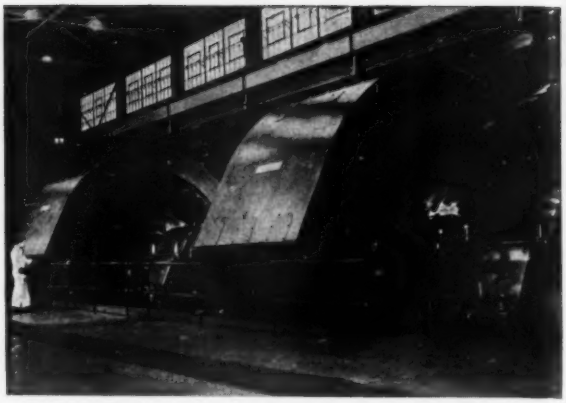
One of the most modern turbine-generators was installed recently in the Sewaren station of the Philadelpha Electric Co.

bilities, he believed, are offered by new insulating materials, improved methods of ventilation, and new cooling media. Some of these improvements can also be applied to water-wheel generator construction, and he thought a reasonable expectation would be waterwheel generators delivering ¼ to ½ more kilowatts with no increase in size or weight.

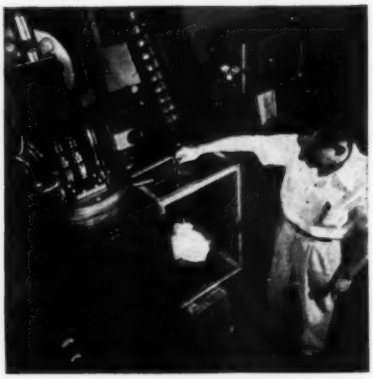
Switchgear

"Development of Switchgear" was the title of a paper by J. B. MacNeil, manager, Switchgear and Control division, who stated that the development of devices to protect electric circuits and systems has always been a race with geometrically increasing problems that are the result of compounding several factors such as larger generators, increasing short circuit ratios, operating in parallel with other stations, need for higher reclosing speeds, and ability to withstand rapidly repeated operations under major faults. He traced the various switchgear developments that have been made from 1896—when "protecting devices for transmission lines were conspicuous by their complete absence"—up to the present time.

The author thought the assumption could be made that a-c generation and transmission will continue to supply the bulk of our power in the future, and that the problem of circuit interruption can be adequately covered by oil circuit breakers and compressed air breakers. While high voltage d-c remains a possibility for future power transmission, formidable problems can be expected, should this development come about, in transforming a-c at the generators to d-c at the line and back to a-c at the load. Present interrupting capacity cannot be assumed to be adequate for the future, since short circuit kva figures of 12,000,000 or even 15,000,000 kva have been considered. But the industry can produce apparatus to handle these concentration when required.



Generators in high power laboratory are capable of supplying 2,500,000 kva for a few tenths of a second.

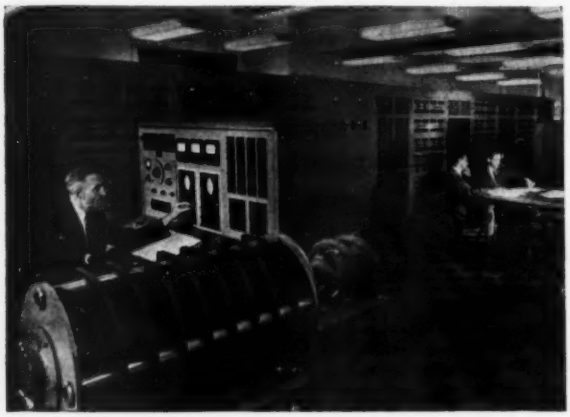


Attain low temperatures with research department's helium cryostat.

Frank Snyder, manager, Transformer division, detailed early developments and then stated that transformers for such super-voltages as 500,000 are expected to offer no insurmountable problems. That the three-phase transformer will be dominant in the future seemed certain to this author. Large high-voltage power transformers will probably be forced-oil-cooled instead of self cooled, and the present trend will continue until gas-filled units supplant other types. With the increase in high-voltage underground transmission, more transformers with cable entrances will probably be used. Then high voltage lines can be completely enclosed and power plants located in congested areas with no overhead transmission lines needed to carry the power to the outskirts of cities. Liquid-filled transformers will largely disappear from industrial plants and office buildings and they will be replaced by air or gas-insulated transformers.

If the designer of tomorrow could be provided with three dream elements —core materials capable of carrying twice as much flux with the same or lower losses as now; a conductor of lower resistivity than copper; and solid insulation with dielectric strength much higher than anything now known and with exceptional thermal conductivity, as well as stability—transformers would be enormously reduced in dimensions, with the core and windings cast into a solid mass of the solid insulation. The steel exterior would become unnecessary, and the whole unit could be buried in the ground, power entering and leaving by underground cable.

A possibility too is that some new synthetic fluid (liquid or gas) will be produced with better insulating qualities than oil. Or the developments may be to no liquids or gases or high pressures—instead, a high vacuum. In a vacuum with nothing to ionize and cause breakdown, the problem of high voltage insulation is greatly simplified. Even if high-voltage, d-c transmission does come, transformers will still be needed. Meanwhile more avenues of transformer development and improvement are being explored than anytime in transformer history.

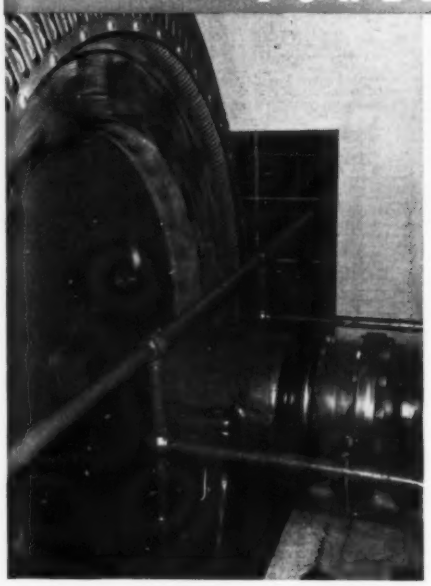


Extremely complex design problems are quickly and easily solved electrically by the analog computer on which synthetic systems are set up.

Motors and Controls

Electrical drives were discussed by L. R. Ludwig, general manager Buffalo division. He outlined the historical progress of motors and controls and then, "looking boldly to the future", he believed the industry's long-range objective is a drive that is un-

(Continued on page 130)



SYNCHRONOUS MOTOR NOW POWERS NICHOLSON FILE'S GROUP DRIVES

Old Corliss engine in Anderson, Indiana plant is replaced with a 600 hp synchronous motor. Some new pulleys were installed to adjust for the higher speed of the motor, but group drives for grinding machines are retained. Arrangement permits continued return on large investment in belting and advantages of high power factor.

O. E. WATSON,
Superintendent of Electrical and Maintenance Departments,
Nicholson File Company, Anderson, Indiana

This synchronous motor replaced engine pictured below. Plant's power factor has increased from .70 to near unity.

THAT all factors must be considered when planning alterations or improvements to mechanical power transmission systems is indicated by the benefits obtained from the latest phase of the extensive modernization program underway at Nicholson File Company's Arcade Works in Anderson, Indiana. Figuratively speaking, company engineers had left "no stone unturned" when they finally decided to retain an existing lineshaft arrangement, for driving two groups of belt-driven grinding machines, and replace a 45-year old Corliss steam engine with a new 600 hp 2400 volt synchronous motor as the source of mechanical power.

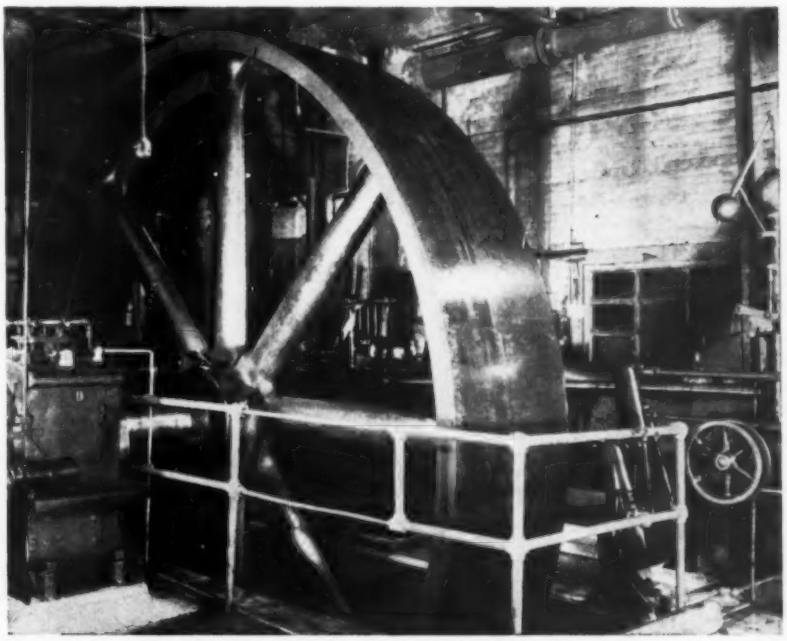
As a result, the company is assured of the maximum return from its large previous investment in installed leather belting and lineshaft equipment. General condition of the present group drives is still satisfactory and they should have many more years of serviceable life. Moreover, approximately 15,000 to 18,000 lb of steam per hour (formerly required by the 24 in. by 42 in. engine) is now available for other purposes. Or, should the additional steam be unnecessary, the load on the boilers can be reduced accordingly.

In addition, installation of the synchronous motor has improved the plant's power factor to such an extent that savings from lower power rates, as well as increased over-all operating efficiency of other electrical apparatus in the plant, is expected to pay for the new equipment within a reasonable length of time. All power is purchased.

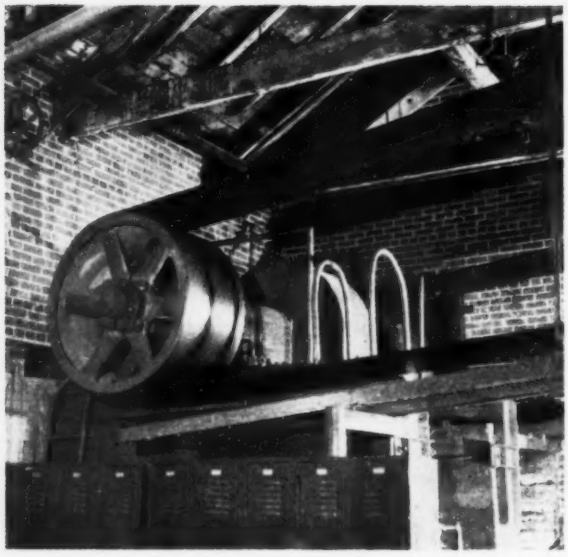
During the years when mechanical power was provided by the steam engine, the plant's power factor reading averaged about .70. Since the synchronous motor has been on the line the reading has jumped to near unity. Unloaded, or with excitation, the motor gives a leading factor of .80.

The old engine, which had served faithfully since 1904, was housed in an old building adjoining the main grinding room. A large leather driver belt from the engine flywheel extended through an opening in the 17 in. brick wall that separated the engine and grinding rooms, and drove a 7½ in. diam. jack-shaft. The jack-shaft, in turn, transmitted power to two lineshafts in the grinding room.

Incidentally, the driver belt was as symbolic of earlier power transmission engineering as the Corliss steam engine. The 36 in. wide 3 ply endless belt had an over-all length of 94 ft



View of Corliss engine just before retirement by modernization program.



New pulleys on extended motor shaft compensate for difference in old and new shaft speeds.

6 in. and required the hides of 90 steers for its manufacture.

When plans were made several years ago to erect a new heat treating plant, part of the old engine room was in the way. The decision was then made to tear down the obstructing structure, retire the steam engine, and install the new synchronous motor. Since the motor requires much less space than the Corliss engine, a smaller brick enclosure was built for it without interfering in any way with construction of the heat-treating building.

The synchronous motor was installed on practically the same centerline as the old jack-shaft, but adjacent to the end of the existing equipment. A new 7½ in. diameter driver shaft, approximately 16 ft long and connected to the motor shaft by a flexible coupling, took the place of the jack-shaft. Some of the original heavy wood timbers that carried the jack-shaft bearings were utilized to support the pillow blocks for the new shaft. The extended shaft projects through the brick enclosure wall into the grinding room.

Since the synchronous motor speed (212 rpm) differed from that of the old jack-shaft (156 rpm), new driver pulleys of such size as to match the original rpm of the lineshafts were installed on the extended shaft. These pulleys are of the solid rim, split hub type.

Remainder of the power transmission system in the grinding room—including 30 in. wide driver belts from the extended shaft to the lineshafts, 6 in. wide belts from the lineshafts to the machines, lineshafts, pulleys, and bearings—remained intact.

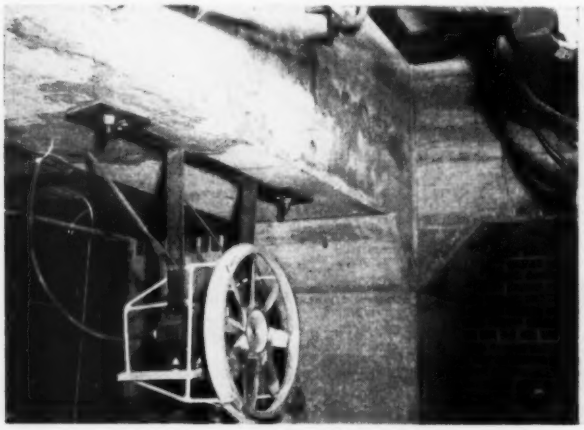
Also included in the new set-up is a 15 kw 250 volt generator provided for excitation of the synchronous motor field coils. This unit is installed in the motor room and is connected to the extended motor shaft by a 10 in. wide flat belt. The synchronous motor is remotely controlled, the starter and automatic transformer type control being located in the plant's main switch-gear room in the maintenance and electrical building.

Obviously, a 600 hp synchronous motor will give off a considerable amount of heat during operation. Therefore, the motor building—being of minimum size—is well-ventilated. Two propeller type fans, one intake and one exhaust, maintain proper operating conditions.

Fresh air is drawn into the structure from the outside at grade level. Incoming air passes through a double bank of spun glass filters to remove all dust and dirt. When the first bank of filters becomes sufficiently dirty to retard the passage of air they are discarded. The second bank of filters is then moved forward and entirely new filters replace the former second set. Under this arrangement, clean air is always available. The filtered air then passes upwards around the motor and is either mixed with the air of the room or exhausted to the outside by the second fan.

Considerable planning was necessary to complete the change-over from the steam engine to the synchronous motor without loss of production. Management decided to work overtime in the grinding room for several weeks prior to the shut-down period. In this manner adequate back-logs of products were built up to keep the balance of the plant in operation while the grinding room was idle.

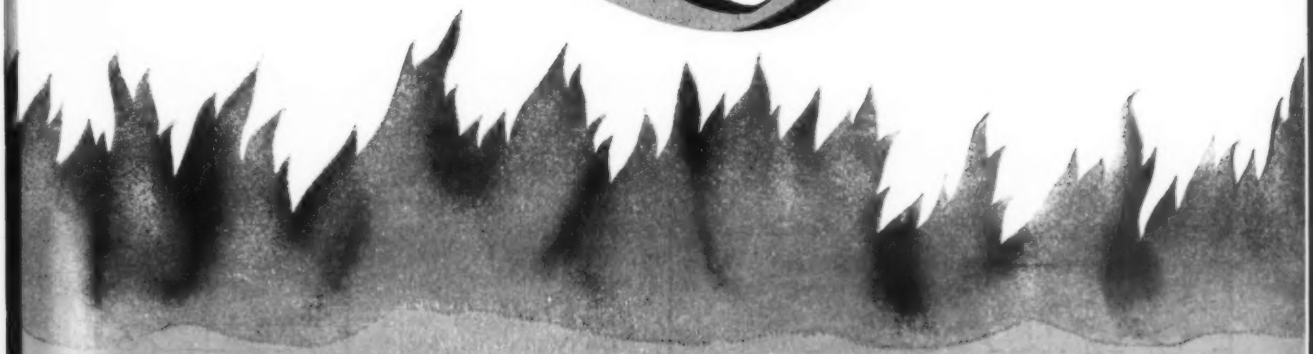
By working around the old equipment, construction crews from the plant's maintenance department were able to erect the forms and pour the concrete for the motor base several months in advance. Thus by the time the motor was set in place the concrete was thoroughly dried and hardened. In the meantime other installation work, such as wiring and setting of the motor starter, was completed as far as possible. When the actual change-over took place and the old steam engine was removed from service, the minimum of production time was lost.



Propeller fan circulates filtered air around motor.

New synchronous motor building adjoins grinding room.

WHY fireye



There's only one reason for putting a Flame Failure Safeguard on an oil or gas burner . . . to prevent an explosion . . . to safeguard your entire plant, equipment, and personnel.

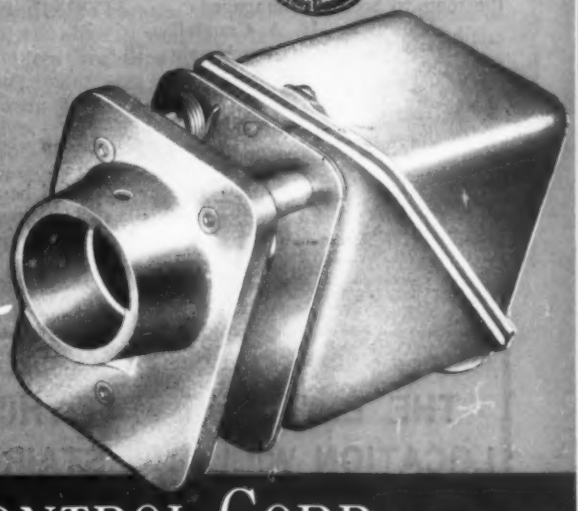
Fireye insures complete flame failure protection because it is photoelectric . . . it sees the flame . . . and if the flame fails, Fireye acts with the speed of light to cut off the fuel *before* dangerous gases accumulate in the combustion chamber.

Controls which do not react instantaneously can *not* provide full protection . . . for it is the few seconds of delay between flame failure and fuel shutoff which charge the combustion chamber with potential destruction.

Fireye is the outstanding combustion safeguard which meets the exacting requirements of insurance laboratories for the protection of ALL classifications of oil and gas burner installations.

FACTORY MUTUAL FM APPROVED

UL



Write for bulletin 604-C

fireye

COMBUSTION CONTROL CORP.

Flame Failure Safeguards for Oil and Gas Burners

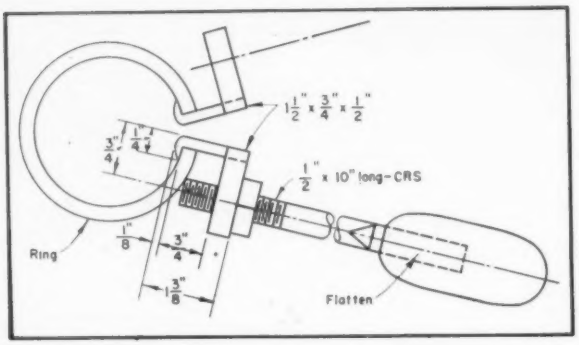
77 BROADWAY, CAMBRIDGE 42, MASS.

How to . . Shop Kinks and Hints . .

What's your idea? Send it and a rough sketch to the How-to Editor.
We pay at least $10.00 for each item published.

HOW TO:
speed removal of piston rings

With a pair of special tools (similar to the one shown in sketch), and a little practice, piston rings on Diesel or gasoline engines can be removed and replaced as fast as they are handed to the operator. Tools are adjustable to all types and sizes of rings up to ¾ in. radial thickness, and opens the rings without changing their concentricity. Operator merely inserts the hooks square with the ends of the ring as illustrated and, with a handle in each hand, moves the tools in opposite directions until ring is opened



enough to clear the grooves. Due to the leverage obtained from the handles, no great effort is required to open the ring. Incidentally the ring does not tend to twist or turn when being opened by this method, but for pistons over 8 in. in diameter a helper should be on hand to steady the back of the ring as the weight of the larger ring may cause the tools to become disengaged.

H. A. Crandall
Chicago Heights, Ill.

HOW TO:
give instruction for personnel evacuation during fires

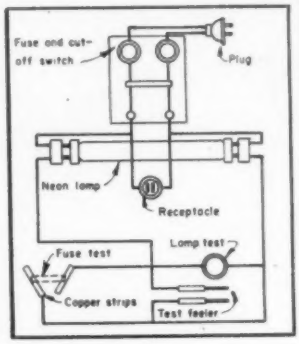
In case of a serious fire every employe should be aware of which stairway and exit door is best suited for departure from any point in the plant. Small stickers can be printed and explicite instructions filled in as illustrated. These stickers will serve as a constant reminder and can be attached to machines and desks, or posted in rest rooms, cafeterias, supply room areas, or any other location.

IN CASE OF FIRE
THE EMPLOYEES AT THIS
LOCATION WILL USE STAIR-
WAY 7 AND DEPART BY EXIT
DOOR 3 SOUTH ST. SIDE

Frederick Jerome
Cincinnati 29, Ohio

HOW TO:
make a simple lamp and fuse tester

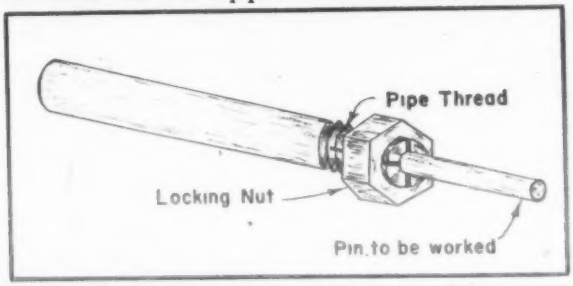
Light bulbs, fuses, or coils can be tested rapidly by means of the well planned test board shown in the schematic wiring diagram. The board can be made portable with the electrical leads long enough to plug into an ordinary wall socket. Cartridge fuses can be tested by placing them across the copper strips, while light bulbs and plug fuses are inserted in a standard socket that has the inner shell flattened. The test feeler can be made any length so as to conveniently check shorts in coils, motors windings, and grounds. Closed circuits will cause a neon or fluorescent lamp to flash. A convenient receptacle may be incorporated if a service light or service extension is desired.



C. A. Wilke
Anklyn-Audubon 6, N. J.

HOW TO:
make a handy pin vise

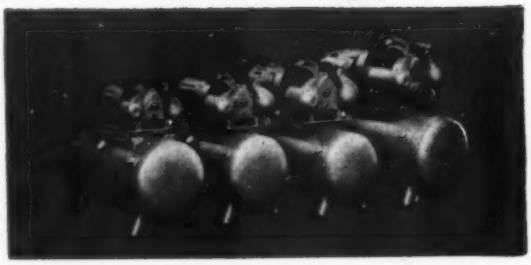
Sometimes when filing or grinding a small pin great difficulty arises in holding the pin securely. One method that can be employed to overcome this problem is to make a pin vise, as shown in the drawing. Drill a piece of round stock to a diameter large enough to hold the pin. Thread the drilled end with a pipe die and slot with two cuts. A



nut tapped out with the same sized pipe tap can be screwed on the end of the pin vise. As the pipe threads are tapered, the jaws of the rod will close as the nut is screwed down firmly to hold the pin.

L. Kasper
Philadelphia 20, Pa.

THE GOOD RIGHT HAND OF INDUSTRY



WORTHINGTON

WORTHINGTON PUMP AND MACHINERY CORPORATION
MERCHANDISING DIVISION
HARRISON, NEW JERSEY

The Good Right Hand of Industry

PCB-15

IT'S THE ONLY REALLY NEW AIR COMPRESSOR LINE SINCE THE WAR — WORTHINGTON'S AIR COOLED AIR COMPRESSOR—½ TO 10 HP.

See what's new about it—

Higher efficiency because the cylinders are completely isolated for better cooling—more heat-radiating surface cooled by six-times-greater volume of air from the high-capacity fan.

Smoother performance because of the better balance of the V-type cylinder arrangement; also: Timken bearings.

Efficient lubrication—visible oil level, lower oil consumption due to latest piston design.

Longer life because the pistons, though different in size, are alike in weight, reducing vibration, and the cylinders are separately removable for minimum replacement cost; also: lower piston speeds, lower bearing pressures, exclusive Worthington Feather* Valve.

So—when you buy an air compressor—remember that the *oldest* name in air compressors—*Worthington*—is on the newest air compressor—Worthington Air Cooled Air Compressor.

Order from your jobber.

*Reg. U. S. Pat. Off.

MAIL COUPON FOR FREE BULLETIN

Worthington Pump and Machinery Corp.
Merchandising Division
Harrison, N. J.
Send bulletin on Worthington Air Cooled Air Compressor line.

NAME.....

COMPANY.....

ADDRESS.....

Spot News

Short, "boiled-down" paragraphs on the most interesting recent events and developments in American industrial plants.

World's Longest Belt Conveyor is Installed at W. Va. Coal Mine

Installation of the world's longest single conveyor belt (mentioned in W. G. Hudson's December article "Belt Conveyors Get Longer and Longer") at the Weirton mine of the Weirton Steel Co. near Morgantown, W. Va., has been announced by The Goodyear Tire and Rubber Co.'s mechanical goods division. This steel-corded belt will transport coal from the washery located near the mine through a tunnel to a tipple on the Monongahela River for loading into barges.

Measuring 10,900 ft center distance between head and tail pulleys, the installation of the endless rubber, steel, and cotton belt establishes a new record for length for any type belt. The former longest belt on record was that in use at the Grand Coulee dam project some 10 years ago. That unit measured 4,985 ft between pulley centers.

The belt for the Weirton mine is 30 in. wide and will deliver approximately 250 tons of coal per hour at a belt speed of 300 fpm. A 200 hp motor is required to drive the belt which has a 135 ft vertical drop in the 10,900 ft between the washery and the river.

Because of unusual dimensional stability of the steel-corded construction, only 25 ft of takeup is required for the 22,000 ft of belt length. The belt weighs approximately 122 tons. More than 152,798 lb of rubber, 50,941 lb of cotton, and 39,754 lb of steel cable were required in the manufacture of the belt.

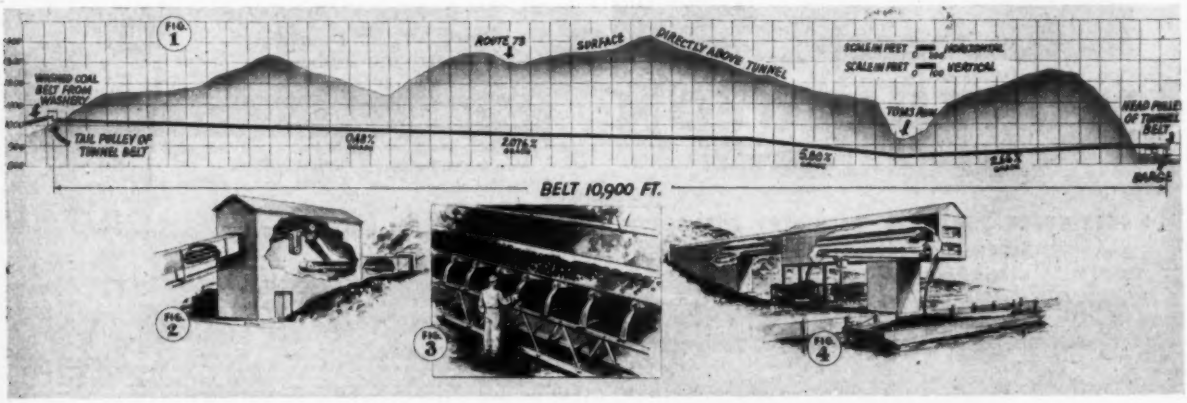
In the accompanying illustration Fig. 1 represents the artist's conception of the profile of the underground conveyor installation; Fig. 2 shows the transfer house and tail end of the conveyor at the mine's washery; Fig. 3 depicts the course through the tunnel; and Fig. 4 shows the general layout of the river tipple and head end of the 10,900 ft belt conveyor.

Standard Control Division Plant at Beaver, Pa. Is Completed by Westinghouse

"Home" for the small air circuit breaker and bus duct manufacturing operations of the standard control division was recently completed by the Westinghouse Electric Corporation at Beaver, Pa., and thrown open for an inspection tour by technical and trade magazine editors. The main elements (6 buildings of 441,670 sq ft of floor space on ap-

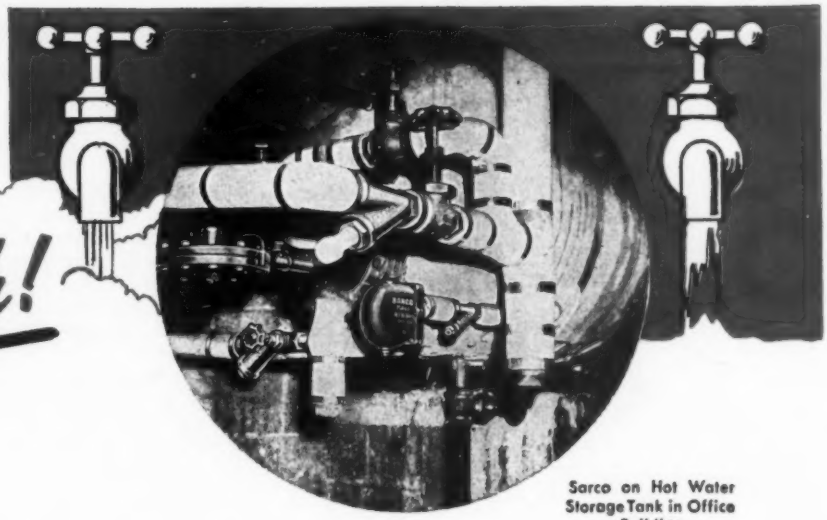
proximately 30 acres) were purchased from the War Assets Administration in March 1947, to consolidate all the small air circuit breaker operations. Since then a new storage building has been added and extensions made to existing buildings to increase the total floor space to around 500,000 sq ft. Real estate holdings have also been extended so the plant area now comprises 75 acres. In addition to air circuit breakers and bus ducts, contactors, linestarters, pushbuttons, load centers, and safety switches are manufactured here.

(Continued on page 114)



HOT WATER COSTS—

too Much!



Sarco on Hot Water Storage Tank in Office Building

Sarco Blender in Apartment

WHEN IT IS TOO HOT OR TOO COLD

Hot water is a critical service, in buildings, in homes, or in industry. Poor service can be "explained" for a time. But when tenants get scalded, or workers "wait for it to warm up" because the water is too cold, things begin to happen that cost you money every day.

The strange thing is that the proper applications of Sarco Steam Traps, Temperature Controls and Water Blenders not only eliminate complaints, but result in lower fuel and water costs.

TANKS

If you have a storage tank—any one of several Sarco Trap-Control combinations will insure constant tank temperatures. Sarco never over heats—therefore it saves fuel. The Sarco 2430 Control shown above is one method.

APARTMENT

The phone rang all day and the boss wanted to install an additional tank. We put in a Sarco Blender at a cost of less than a dollar per apartment — now no complaints and much less water is wasted waiting "for it to get right."

INDUSTRIAL APPLICATION

The Sarco Water Blender is doing a good job in industry too. It insures exact temperatures at the point of use. In foods, it saves raw materials and rejected batches by having the water just right at the cooker or mixer. It is used for recirculating brine and cooling water in engines and compressors, and is the standard for wash rooms and gang showers. Bulletin No. 800.

254

SARCO COMPANY, INC.

Represented in Principal Cities

Empire State Building, New York 1, N. Y.

SARCO CANADA, LTD., TORONTO 5, ONTARIO

SARCO SAVES STEAM

IMPROVES PRODUCT QUALITY AND OUTPUT

Guaranteed to save
TIME, WORK AND CASH

"The tougher the job, the tougher the tools have gotta be—for me that's RIDGIDs."
If this Housing ever Breaks or Distorts we will replace it Free
TRADE RIDGID MARK

RIDGID's guarantee means no pipe wrench housing expense—at all, ever

● Workers everywhere like the work-saver features that make RIDGID the world's favorite. Housing is guaranteed against breakage or distortion. Adjusting nut spins easily in all sizes 6" to 60." Handy pipe scale on hookjaw. Instant-action non-slip, non-lock jaws. Powerful comfort-grip I-beam handle with flared end that won't let your hand slip off. RIDGIDs save your time and money. Buy them at your Supply House.

RIDGID
WORK-SAVER PIPE TOOLS
THE RIDGE TOOL CO. • ELYRIA, OHIO

(Continued from page 112)

Sheet steel is received in shrouded skid loads of 6000 lb and handled to storage by floor-controlled overhead cranes equipped with sheet grabs. Many non-ferrous materials are received in boxes and also handled by overhead cranes. All other raw materials are handled by a fork truck-pallet system.

Some of the production processes—such as plating, heat treating, cleaning, and bonderizing—create considerable acid and alkaline wastes. Instead of dumping these products into the nearest stream or sewer, a new continuous waste neutralizing plant has been built and now treats around 100,000 gal of waste waters, acids, and alkalines a day.

Departments of the well laid out plant include small parts fabrication; heat treating, brazing, plating, tumbling and deburring, bonderizing, and of course assembly, inspection, storage, tool room, and maintenance. An electrical laboratory, temperature control room, boiler house, and substation are provided. Scrap handling has been facilitated by the use of dump bottom scrap boxes, which are handled by fork trucks fitted with special attachments for dumping.

Purdue University to Sponsor 5th Annual Industrial Recreation Conference

The fifth annual Industrial Recreation Conference will be held at Purdue University, Lafayette, Indiana on February 16 to 18. Special problems and the most recent developments in the organization and administration of industrial recreation programs will be discussed by outstanding leaders in the field. Each delegate will be afforded ample opportunity to present individual questions or problems.

For the most part conference sessions will be conducted on a round table discussion period basis under competent, experienced leaders. Selected session subjects include: "Music in the Employe Recreation Program", "Recent Research Findings in Industrial Recreation", "Financing the Employe Recreation Program", "Organizing a City Industrial Recreation Council", "Elements of a Balanced Program", "Self-Improvement Suggestions for the Employe Recreation Director", and "Industrial Recreation Problems Clinic."

The conference is sponsored by the university's division of education and applied psychology and the technical extension division. Cooperating organizations include the Greater Lafayette Industrial-Commercial Recreation Council, the Indiana State Chamber of Commerce, the Indiana State Personnel Association, the National Industrial Recreation Association, and the Purdue Chapter of the American Recreation Society.

Representatives from industries, private and public agencies, and city recreation councils interested in a discussion of the latest developments in industrial recreation are invited to attend. Reservations may be made or information obtained by writing to: Industrial Recreation Conference, Technical Extension Division, Purdue University, Lafayette, Indiana.

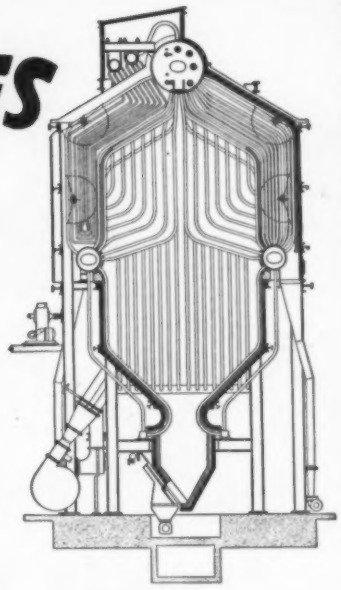
New Gas Engine Compressor Undergoes Initial Shop Tests

Recently technical officials and engineers of large gas transmission companies, witnessed with keen interest the initial shop tests of Worthington Pump and Machinery Corporation's new gas engine gas compressor.

Results of the trial runs, which were conducted at Worthington's Buffalo Works, forcibly demonstrated the advan-

(Continued on page 116)

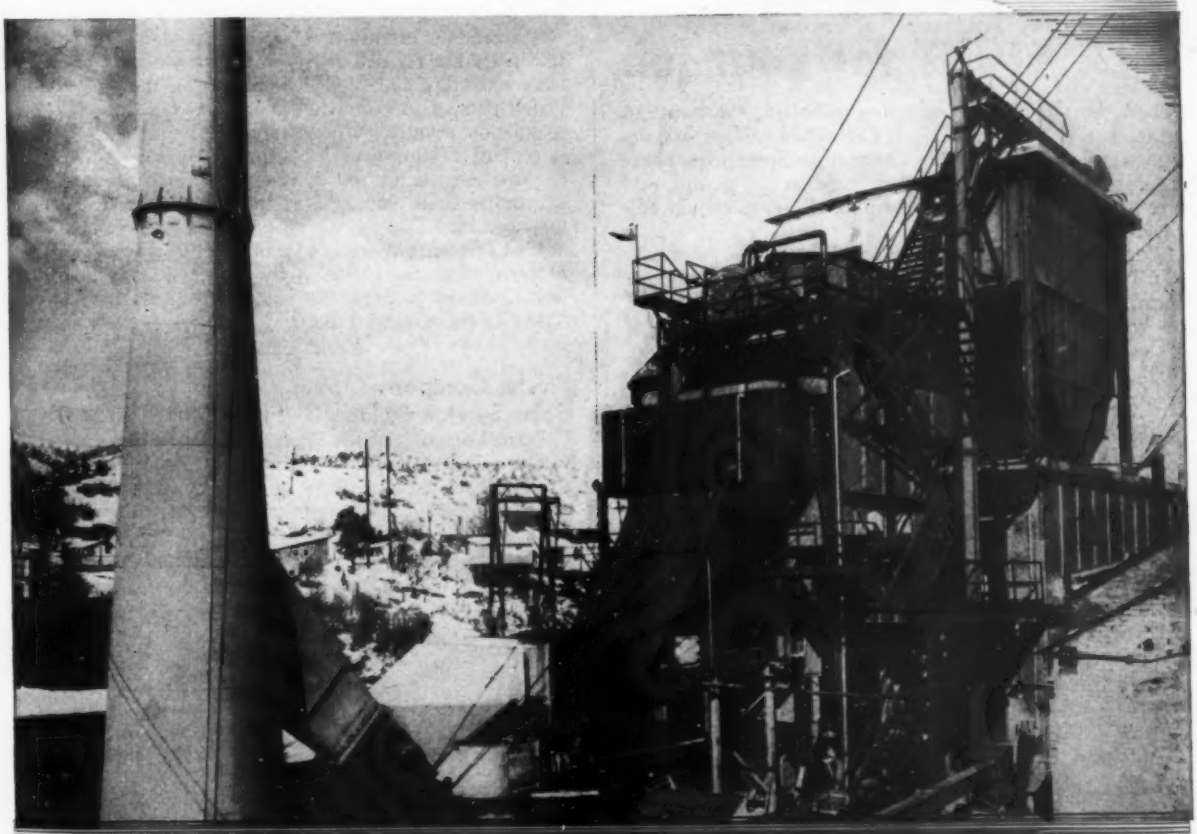
UNION OUTDOOR STEAM GENERATING PLANT *in the* ROCKIES



This Union "H" Type steam generator requires no costly building to house it. The steel cased boiler with superheater, dust collector, air heater, ducts, fans and stacks are out-of-doors, at 6500 feet elevation.

It is designed for 60,000 pounds of steam per hour at 450 psig and 750 Deg. F., fired with pulverized coal, oil and gas combination fuel burning equipment.

The superheater is located on one side only, providing constant superheat over a wide load range by automatic adjustment of the boiler outlet dampers controlling the gas flow across the superheater.



UNION IRON WORKS • • *Since 1890*

103 Cascade Street • Erie, Pa., U. S. A.

BOILERS • PROCESS EQUIPMENT • FABRICATED STEEL

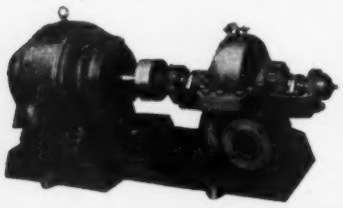
"We MUST have DEPENDABLE pumps"

"Yes Sir! I'll talk to a WEINMAN expert"

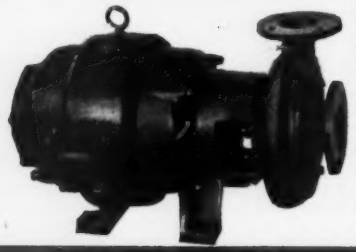
WEINMAN PUMPS are designed RIGHT for your job

Whenever you have a pumping problem, the name to remember is WEINMAN. WEINMAN pumps are designed and manufactured by Centrifugal Specialists. These men are concerned with but one product . . . pumps, and one objective . . . making them work at maximum efficiency on every job.

For day-in, day-out, trouble-free service, you can't beat WEINMAN pumps. If your plant handles liquids in any form, it will pay you to talk with WEINMAN. A letter, telegram or 'phone call will get the prompt attention of a Centrifugal Specialist . . . anxious and able to help.



WEINMAN Type JC High Head SPLIT-CASE Pump. Two Stage back to back impeller design. Capacity up to 600 G.P.M., heads to 600 feet.



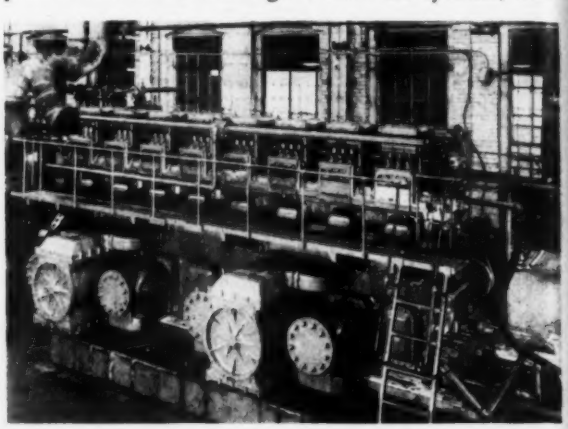
WEINMAN General Service UNIPUMP. Used where space is limited. Can be mounted in any position. Capacity to 1000 G.P.M., heads to 500 feet.

Built by Centrifugal Specialists

The WEINMAN Pump Mfg. Co.

(Continued from page 114)

tages of the scavenging principle gas engine compressor. Air inlet ports located around the circumference at the bottom of the cylinder and dual mechanically operated exhaust valves at the head were demonstrated to produce perfect clearance of burnt gases from the cylinder; com-



plete charging with clean air; extremely low exhaust temperatures; and assured load carrying ability. Particular note was taken of the characteristic of the unit to operate with entire satisfaction at reduced speed and loads.

Tremendous extension of gas transmission lines the last few years has focused attention on the importance of utmost reliability and highest efficiency in the gas engines which pump fuel from the natural gas field areas to our population centers. Worthington engines have carried a large part of this load for almost fifty years. The new engine design is a direct descendant of pioneer equipment which has been employed in this type of service over a long period.

First permanently installed unit will be made at the West Monroe, Louisiana station of the Tennessee Gas Transmission Company to pump natural gas from the Rio Grande Valley to the Niagara Frontier.

Hyster Company Opens Modern Sales-Service Building in Frisco

Formal opening of the Hyster Company's new industrial truck retail sales and service building at 4445 Third Street, San Francisco 24, California, was held recently according to an announcement from Ray Ronald, western division sales manager. The new store, covering 10,000 sq ft, is located on a four-lane, arterial highway in a rapidly developing

industrial area, and is considered one of the most modern material handling equipment distributorships in the United States. Complete service for all makes of industrial trucks is provided in the 7,200 sq ft of the maintenance shop.

On display were the new show room, offices, parts and service departments, and seven different models of indus-

(Continued on page 118)

ssor.
the
l ex-
duce
com-

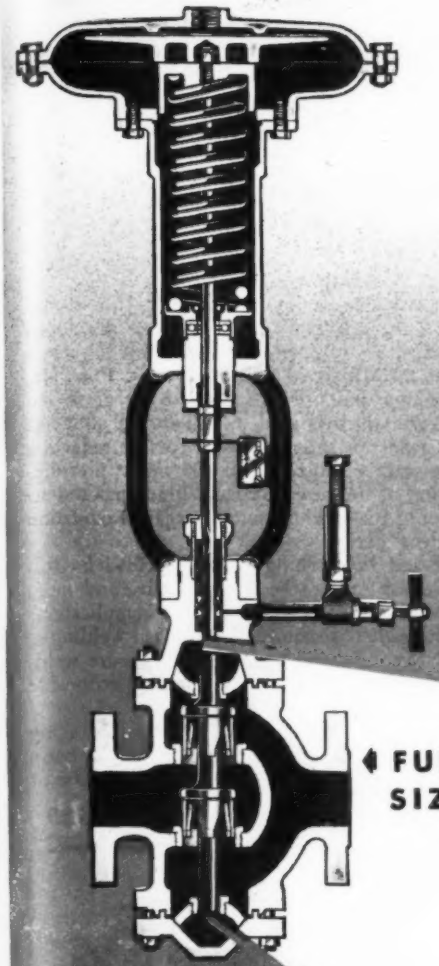
tem-
cular
erate

last
f ut-
gines
our
ed a
new
ment
ver a

West
smis-
ande

strial
treet,
ng to
sales
cated
pping

dern
nited
rucks
pp.
and
ndus-



RESTRICTED INNER VALVE PROCEDURE FOR FISHER DIAPHRAGM CONTROL VALVES . . . . . .

The introduction of Fisher's new restricted inner valves offers a quick, economical and completely satisfactory way to reduce the effective capacity of a larger nominal valve size.

INTERCHANGEABLE

◀ FULL SIZE

◀ 1 SIZE SMALLER

2 SIZES ◀ SMALLER

PRACTICAL

For example, a 4" valve can quickly be converted to flow capacity of a 3" 2½", or 2" size. This is accomplished by the restricted V-Port Inner Valve alone—without changing seat rings. Inner valves with equivalent smaller size valve area or capacity are fully interchangeable with standard full size inner valves. Inner valve skirts are cast stainless steel with wide range percentage characteristics port areas. Cast skirts are welded on to stainless steel bar stock center post guide. Further details and application data gladly furnished on request.

FISHER GOVERNOR COMPANY MARSHALLTOWN, IOWA

The OLD MAID treatment For FLEXIBLE METAL HOSE

● Recently, an Atlantic engineer scanned specifications on an order for flexible metal hose . . . A question as to dimensions! . . . A call to the client . . . A typing error corrected—a very costly mistake avoided . . . Final comment by the client, "You're as finicky as an Old Maid in attention to detail. Thanks!"

● Just routine but your assurance of satisfactory solution of every hose problem. That's why every length of Atlantic metal hose is ***job tested and guaranteed to do its job.***

ATLANTIC METAL HOSE is ***better*** for isolating vibration, connecting misaligned stationary and moving parts, mobile service, eliminating rigid bent pipe and fittings . . . for conveying live steam, compressed air, chemicals, light and semi-solids.

Bronze, steel or stainless steel. Size 1/8"-36" I.D. inclusive. Standard or special couplings, flanges, nipples and fittings.

WRITE FOR BULLETINS . . . .

ATLANTIC METAL HOSE CO., Inc.
124 West 64th Street, New York 23, N. Y.

(Continued from page 116)

trial trucks and a number of special-purpose attachments, manufactured by the Hyster Company at its factories in Portland (Oregon), Danville and Peoria (Illinois).

R. L. Golden is manager of the organization, whose staff of 18 persons handles industrial truck sales and service in 43 counties of northern California and 11 counties of western Nevada.

New Process Saves Time in Boiler Tube Welding

High quality of welds, saving of time, and a more simple method are advantages of the new process developed at the Chattanooga, Tenn. plant of Combustion Engineering-Superheater, Inc. for welding boiler tubes. Principles of induction heating and pressure welding are employed in the new process which is used to make tube joints. A high frequency generator supplies power for the induction coil, the heating from which serves in effecting a pressure-type weld. Feature of the new apparatus is an enclosed atmosphere to protect the welding surfaces against oxidation during the heating period.

Both straight and bent tubing may be welded by this method, which is expected to be less expensive and more uniform than hand welding and avoids the complications of internal cleaning that is required when flash welding is used. By combining induction heating and pressure welding, pressure-type welds may be made without objectionable upsetting of metal in the welding zone.

This process is capable of handling materials ranging from 1 in. to 10 in. in dia. Actual welding time is but a few seconds, depending upon the size of material. Use of

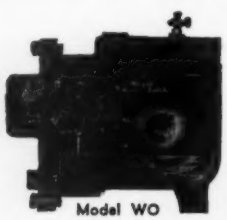
(Continued on page 120)

Enormous DRAINAGE CAPACITY of Nicholson

PISTON-OPERATED SUPER-TRAP

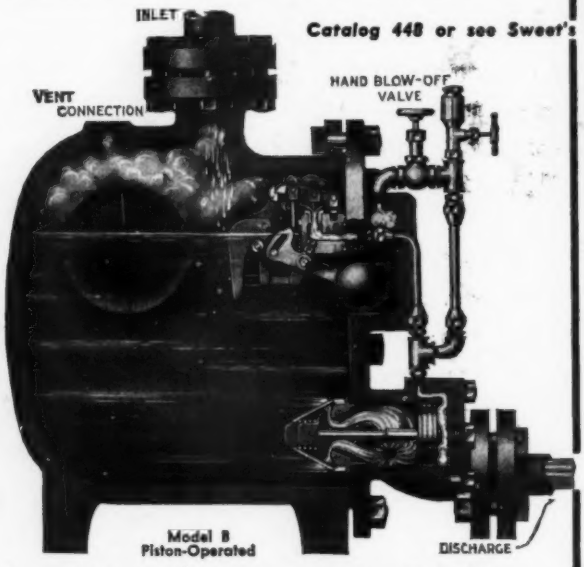
DISTINGUISHES IT IN POWER SERVICE

With valve orifices up to 2" diam., Nicholson piston-operated steam traps offer unsurpassed drainage capacity. Universally specified for draining steam purifiers in power plants, where thousands are in use; discharge large volumes of water almost instantly. Increasingly installed wherever water and dirt in volume are a problem: superheated steam lines, headers, separators, heaters. Other features: won't leak even if cooked dry; rugged; working parts of stainless steel. Press., 2 to 650 lbs. The lowest price large-capacity trap.



Model WO

NICHOLSON WEIGHT-OPERATED, TRAPS (left)—Three models for press. to 200, 650 and 1500 lbs.; for steam, air, gasoline. Also feature large capacity and proof against leaking.

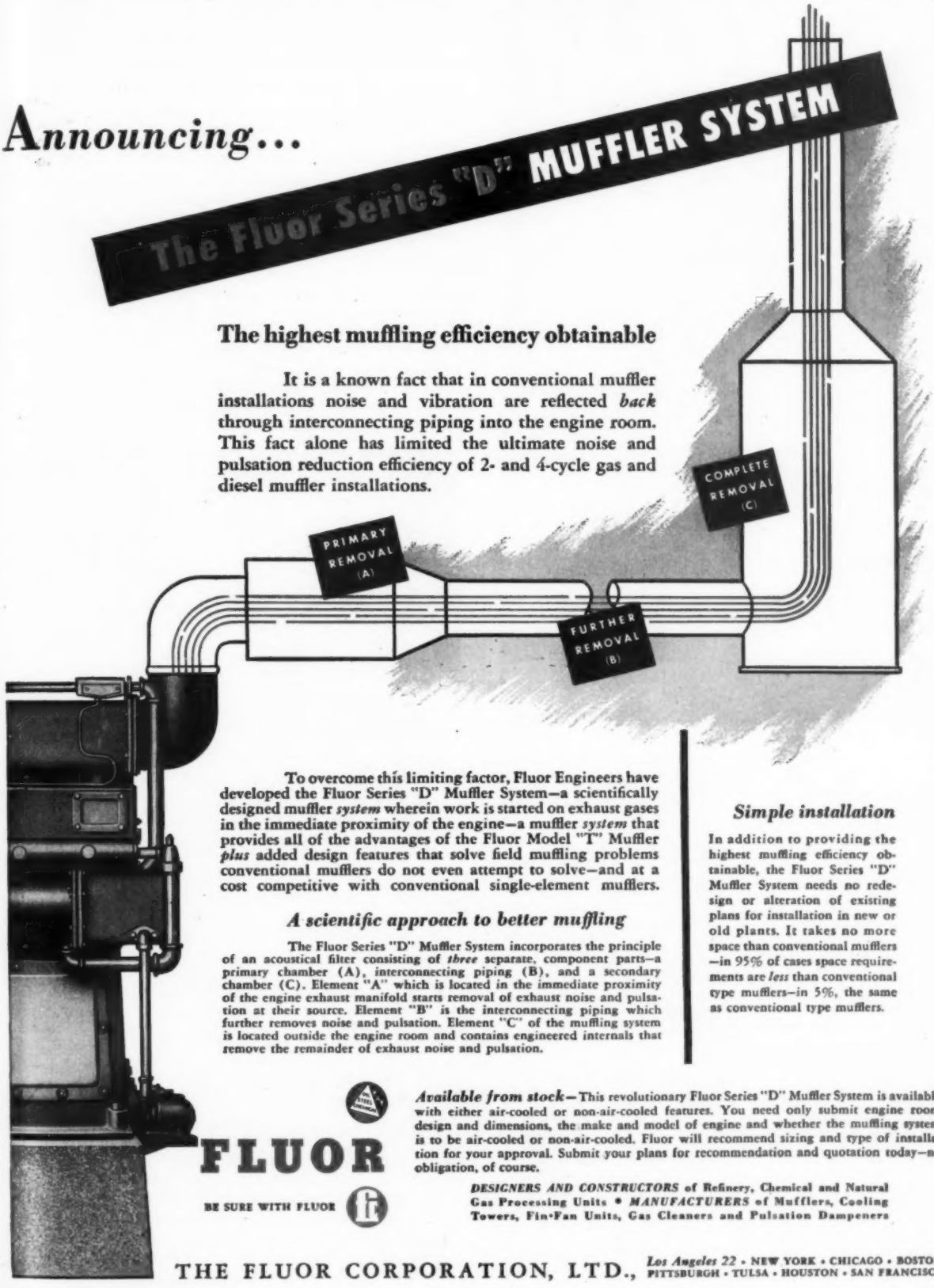


W. H. NICHOLSON & CO.
135 OREGON ST., WILKES-BARRE, PA.

Representatives, in 53 Principal Cities, to Help You Solve Specification and Maintenance Problems in Traps, Floats, Control Valves.

Announcing...

The Fluor Series "D" MUFFLER SYSTEM



The highest muffling efficiency obtainable

It is a known fact that in conventional muffler installations noise and vibration are reflected *back* through interconnecting piping into the engine room. This fact alone has limited the ultimate noise and pulsation reduction efficiency of 2- and 4-cycle gas and diesel muffler installations.

To overcome this limiting factor, Fluor Engineers have developed the Fluor Series "D" Muffler System—a scientifically designed muffler *system* wherein work is started on exhaust gases in the immediate proximity of the engine—a muffler *system* that provides all of the advantages of the Fluor Model "T" Muffler *plus* added design features that solve field muffling problems conventional mufflers do not even attempt to solve—and at a cost competitive with conventional single-element mufflers.

A scientific approach to better muffling

The Fluor Series "D" Muffler System incorporates the principle of an acoustical filter consisting of *three* separate, component parts—a primary chamber (A), interconnecting piping (B), and a secondary chamber (C). Element "A" which is located in the immediate proximity of the engine exhaust manifold starts removal of exhaust noise and pulsation at their source. Element "B" is the interconnecting piping which further removes noise and pulsation. Element "C" of the muffling system is located outside the engine room and contains engineered internals that remove the remainder of exhaust noise and pulsation.

Simple installation

In addition to providing the highest muffling efficiency obtainable, the Fluor Series "D" Muffler System needs no redesign or alteration of existing plans for installation in new or old plants. It takes no more space than conventional mufflers—in 95% of cases space requirements are *less* than conventional type mufflers—in 5%, the same as conventional type mufflers.

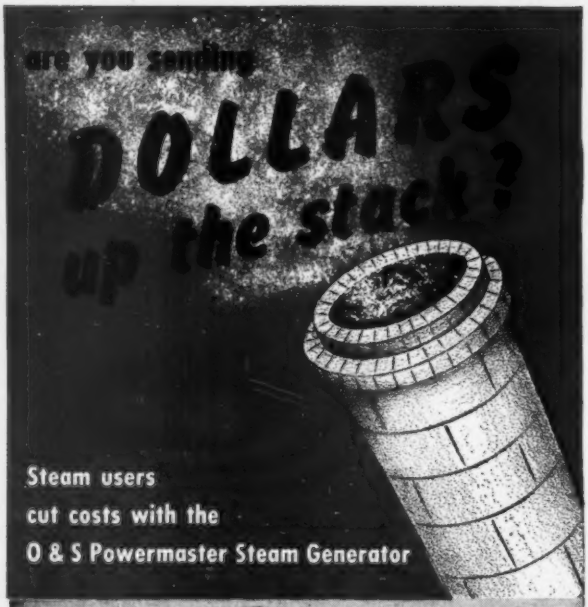
FLUOR

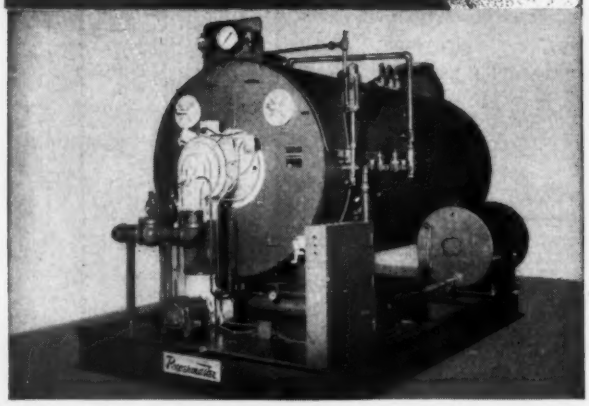
BE SURE WITH FLUOR

Available from stock—This revolutionary Fluor Series "D" Muffler System is available with either air-cooled or non-air-cooled features. You need only submit engine room design and dimensions, the make and model of engine and whether the muffling system is to be air-cooled or non-air-cooled. Fluor will recommend sizing and type of installation for your approval. Submit your plans for recommendation and quotation today—no obligation, of course.

DESIGNERS AND CONSTRUCTORS of Refinery, Chemical and Natural Gas Processing Units • ***MANUFACTURERS*** of Mufflers, Cooling Towers, Fin-Fan Units, Gas Cleaners and Pulsation Dampeners

THE FLUOR CORPORATION, LTD., *Los Angeles 22* • NEW YORK • CHICAGO • BOSTON PITTSBURGH • TULSA • HOUSTON • SAN FRANCISCO





FUEL COSTS REDUCED as much as 40% through high efficiency maintained regardless of fluctuating loads.

OPERATING COSTS REDUCED — fully automatic unit cuts labor and maintenance time to minimum.

INSTALLATION COSTS REDUCED because the Powermaster is completely wired, factory-tested and delivered on steel base. No brickwork required. No unnecessary dead weight. All units constructed to A.S.M.E. Boiler Code and approved by Underwriters' Laboratories.

High and low-pressure units from 15 to 300 HP.—available for light oil, heavy oil, gas or combination gas-oil firing. Widespread service by factory-trained men.

ORR & SEMBOWER ®
Established 1885
Powermaster
STEAM GENERATORS

ORR & SEMBOWER, INC.
951 Morgantown Rd., Reading, Pa.

Please mail latest catalog showing Powermaster's cost-cutting advantages.

Name_____

Company_____

Address_____

City_____ Zone_____ State_____

(Continued from page 118)

backing rings is avoided, and welds may be made of one alloy steel to another or of alloy steel to carbon steel.

Wiegand Lays Cornerstone for New Addition to Manufacturing Facilities

One feature of the recent Pennsylvania Week activities in the Pittsburgh district was the laying of the cornerstone for a new 5 story structure by Edwin L. Wiegand, founder and chairman of the board of the Edwin L. Wiegand Company. When completed this building will add 73,000 sq ft of space to the existing office, research, manufacturing, and warehousing facilities of the Wiegand Company.

Organized in 1917 to manufacture electric heating units, the Wiegand company has been at its present Thomas Boulevard location in Pittsburgh since 1929. From a modest plant employing less than 100 men, the company has grown rapidly and steadily into an organization which now employs over 1100 men in its plant and offices and is represented by over 125 field engineers in key cities throughout the country. The new building marks the sixth major expansion program of the company.

Today, the Edwin L. Wiegand Company is the world's largest manufacturer of electric heating units exclusively, and its total plant facilities occupy 280,000 sq ft of building

space on a seven-acre plot. Over 15,000 various types, sizes, and ratings of electric heaters and equipment are produced for thousands of industrial, commercial and, domestic heating applications.

Officers of the company present during the cornerstone laying by Mr. Wiegand included: Ernest N. Calhoun, president; A. P. Wiegand, vice president, manufacturing; M. M. Greer, vice president, engineering; and B. A. Fleming, vice president, sales.

Large Hose Units Being Constructed for River Dredging Service

Rubber hose units measuring more than three feet inside diameter and weighing more than four tons each have been announced by the Goodyear Tire and Rubber Company. Classified as sand suction and discharge hose, these "grandaddy" hoses will be installed on "dust pan" type dredges that are working the Mississippi River and are said to be the largest being built today.

Production of the 38 in. I. D. hose, in 20 ft lengths,

(Continued on page 160)

Dependable Industrial Coals for LOWER STEAM COSTS!

● These two trade-marked coals are being shipped to more and more industrial plants as they continue to prove their value as low-cost steam producers.

One of Southern's experienced fuel engineers will be glad to tell you how GRAHAM or BROWDER coal is quickly amortizing new plant investments in numerous locations. A positive way to find out about the money-saving characteristics of these coals is to test the one our engineers recommend in *your* plant.

STEADY PRODUCTION • TREMENDOUS RESERVES • IMMEDIATE SHIPMENT

GRAHAM COAL

● Specifically prepared for industrial or utility use GRAHAM Coal and BROWDER Coal deliver exceptional efficiency and daily economy. Produced in Western Kentucky by the most modern methods known to the industry... and ready to serve you every producing hour.

For a comprehensive picture of the entire Southern organization and a complete listing of the coals now being offered by Southern, write for specially prepared brochure. Sent promptly on request.

BROWDER KENTUCKY COAL

● SPECIALIZED SERVICE from our staff of fuel engineers is available always. They can provide you with a technical service on industrial coals backed by 53 years experience in the coal business. On request, one will welcome the opportunity to counsel with you.

Write or Telephone Our Nearest Office

Southern Coal Company, Inc.

SOUTHERN COAL COMPANY INC

General Office: 333 North Michigan Avenue, Chicago 1, Ill.

Offices in: ATLANTA, BIRMINGHAM, CHARLOTTE, CHICAGO, KNOXVILLE, LOUISVILLE, MEMPHIS, NASHVILLE, ST. LOUIS

Sinclair Coal Company, Kansas City 6, Mo.—Western Representatives

Boon-Strachan Coal Company, Ltd., Montreal—Canadian Representatives

MEMBER BITUMINOUS COAL RESEARCH, INC.

(49-GB)

SUPERINTENDENT OF MAINTENANCE
Mr. James Reddrick

"Even with three Dustube Dust Collectors in our cleaning room, we have not spent a dime on repairs for years. Maintenance is easy and inexpensive with few working parts to wear. Inspection of the tubes takes only a few minutes of our regular oiling crew — one glance tells tube condition. The Dustube is certainly the least expensive of all dry type collectors to operate and maintain. And I can go one step further and say that the Dustubes are the most trouble-free pieces of equipment in our whole plant."

AT THE OLIVER CORPORATION
South Bend, Indiana
ALL AGREE ON ONE POINT:

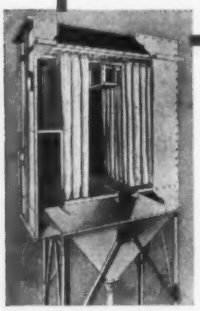
It pays to own a DUSTUBE!

CLEANING ROOM FOREMAN
Mr. John Sokola

"The cleanliness of our gray iron and malleable cleaning room is evidence of the high efficiency of the Dustube Dust Collector. They have to be good to handle the heavy volume of dust created in our foundry — one Dustube ventilates 30 grinders, 10 tumbling mills, a large Wheelabrator Cabinet and a Tumblast. The other Dustube collects the dust from 12 grinders and from two large Wheelabrator Tumblasts. Because of the efficient method of shaking a Dustube, shaking periods are short — there is no delaying of our cleaning room schedule for this operation."

GRAY IRON AND MALLEABLE FOUNDRY SUPT.
Mr. William Johnson

"In terms of efficiency and cost-saving performance, our Dustubes are the best investment we have ever made. Operating costs are confined to supplying power for the fans and shakers. Power costs are exceptionally low due to the ample spacing of the tubes which decreases resistance to air flow. There are practically no maintenance costs. We have experienced no cloth wear from the abrasive action from the dust-laden air."



DUSTUBE ADVANTAGES

Better Dust Removal
Power Savings
High Efficiency
Ease of Operation
Dustube Filters
Filter Replacement

Write today for complete information about the many advantages of Dustube collectors. Ask for Catalog 72-A

American dustube COLLECTORS

OFFICES IN PRINCIPAL CITIES

AMERICAN WHEELABRATOR & EQUIPMENT CORP. 554 S

Condensers

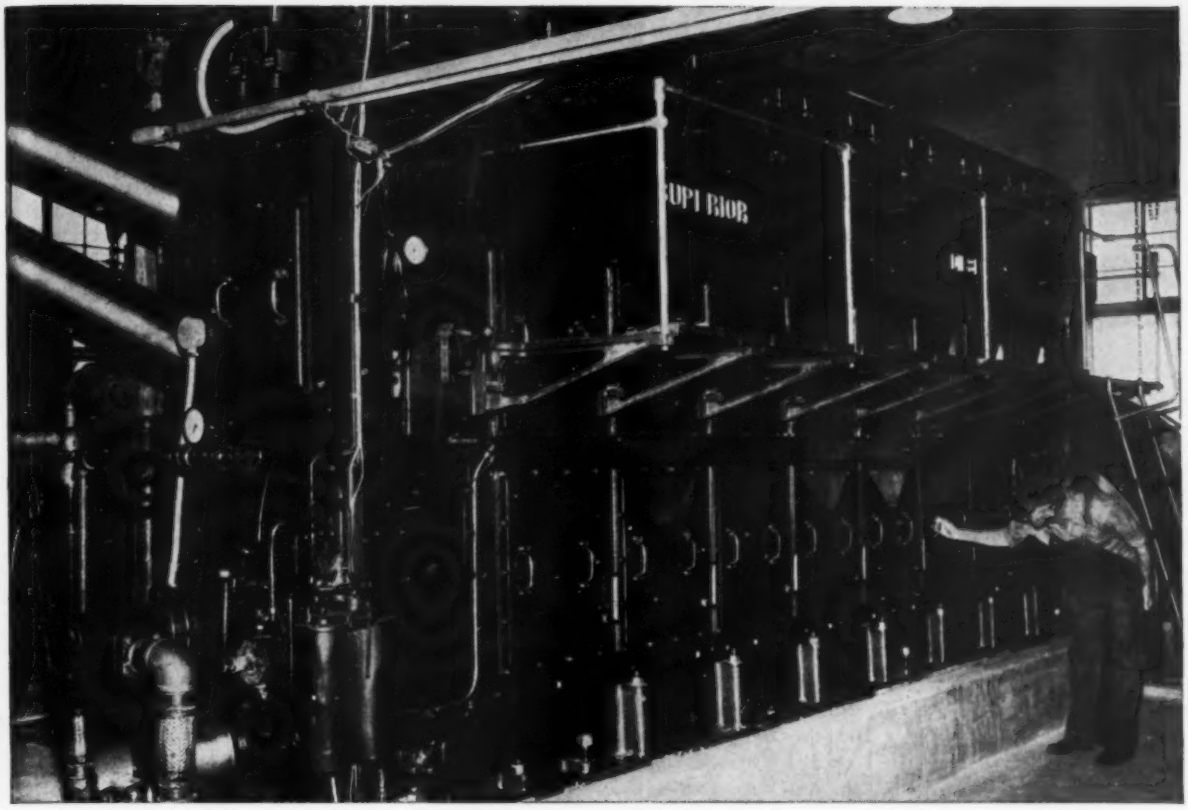
(Continued from page 77)

sign. No. 18 BWG is the most common thickness for tubes, but when steam impingment, vibration, or contaminated circulating water are problems, No. 16 gage tubes are sometimes used. Tube length is a function of condenser shell diameter, a reasonable proportion between shell diameter and length being desirable for good heat transfer. Of course the tubes must be short enough to permit replacement in the space available in the plant. The arrangement of tubes in the tube sheets is controlled by the condenser builder. Tube spacing is usually wide at the steam inlet, but it decreases progressively until the spacing is minimum at air-vapor outlet.

Circulating water velocity should not, in general, exceed 8 fps. Under normal operating conditions a water volocity of 6 to 7 fps is most economical. High velocities are avoided, because friction losses increase with the velocity and more power for pumping is required. On the other hand, low velocities are undesirable, because, as shown by Fig. 2, the coefficient of heat transmission, U, decreases with velocity. Naturally a lowered coefficient of heat transmission reduces the steam condensed by a given area of condenser surface.

Cleanliness factors vary with deposits in the tubes. Values ranging up to 100% are encountered in actual operation, but usually a value somewhere between 70 and 85% is assumed in planning calculations. Such assumption is on the safe side, since average cleanliness factors will generally be less than 100%. Too low a cleanliness factor should not be considered in planning, as then the condenser will be oversized for the load.

When complete costs of the condensing system are known, a graphical analysis, Fig. 4, can be made to determine the most economical area. In making the analysis the required area is computed, as explained in the foregoing, and several standard size condensers chosen—some with more area than required and some with less area. Then, assuming a series of water velocities between 4 and 8 fps, the weight of steam condensed, temperature rise of the cooling water, vacuum obtainable, and necessary pumping head are determined. Next, the annual cost of pumping, turbine steam, tube replacements, and fixed charges on the condenser (depreciation, taxes, and insurance) are found. With these data, curves similar to those in Fig. 4 can be plotted. The various results obtainable are exemplified and discussed on the figure.



How Superior's Dual Fuel Feature Saved $10,000 in Six Months

Folks in a Nebraska town opened the door to lower power costs with a Dual Fuel Superior Diesel. By operating on gas, this Model 80 Dual Fuel Superior saved approximately $10,000 in fuel in six months. What's more, maintenance costs are staying at a low level even when gas is used.

As a result of these substantial savings, this Nebraska town ordered another Model 80 Superior Diesel. This engine is also capable of developing 1440 HP with 1000 KW capacity at 360 RPM on *either oil or gas.*

It's easy to switch from oil to gas or from gas to oil with a Superior. It can be done instantly . . . with a flick of a finger . . . all the operator has to do is push a button.

Our representative can give you all the details on this and other successful Superior installations. Chances are he can help you accomplish the same results. Just write and tell us when he should call or, if you prefer, send for a fully illustrated booklet.

THE NATIONAL SUPPLY COMPANY
SUPERIOR ENGINE DIVISION
Plant and General Sales Office: Springfield, Ohio

THE NATIONAL NSCO SUPPLY COMPANY

Superior DIESELS

Locomotive · Marine · Oil Field · Stationary

DESIGNED TO SAVE *You* MONEY!

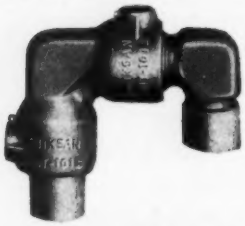
After several years of research and development, CHIKSAN is now ready with two new types of High Temperature Joints which represent the latest in design and performance. They are built specifically to answer the many problems encountered in the handling of steam and other high temperature fluids on rotating equipment and in flexible lines.

Maximum Working Pressure—150 lbs. steam.
1", 1½" and 2" sizes now available. Other sizes under development.
Cadmium Plated Chrome Seal Face.
Rotating speeds, 150 to 300 R.P.M.
Built to *serve*. Built to *last*.

NOW!

CHIKSAN HIGH TEMPERATURE ROTATING JOINTS

Designed and built for use on rotating drums, platens, tumblers, etc. This new Rotating Joint will handle steam, hot oil, water, brine, etc. Rotation may be constant or intermittent. The service may be hot or cold. A positive seal prevents leakage at all times. Packing chamber is hard-chrome plated. All parts are resistant to rust and corrosion.



Made in 8 different styles for turning in 1, 2 and 3 planes.
1", 1½" and 2" sizes now available. Other sizes under development.
Positive Metallic Seal.
Maximum working pressure 300 psi.
Maximum temperature, 600° F.

NOW!

CHIKSAN HIGH TEMPERATURE SWIVEL JOINTS (Metallic Seal)

These new Joints set new performance standards wherever steam or other hot fluids are handled through flexible lines. The Metallic Seal provides positive protection against leaks. Full 360° turning on stainless steel ball bearings which help to absorb radial and thrust loads. Unlimited flexibility is possible simply by arranging the swivels in proper sequence.

COMPLETE ENGINEERING DATA

Write for illustrated bulletins and see for yourself how these new CHIKSAN Joints can help you cut leakage losses, operating and maintenance costs, and shut-down time now required for frequent repairs and replacements.

REPRESENTATIVES IN PRINCIPAL CITIES

CHIKSAN TRADE MARK REG.

CHIKSAN COMPANY
AND SUBSIDIARY COMPANIES
Chicago 3 · **BREA, CALIFORNIA** · New York 7
WELL EQUIPMENT MFG. CORP. · HOUSTON 1, TEXAS
CHIKSAN EXPORT CO. BREA, CALIFORNIA · NEW YORK 7

BALL-BEARING SWIVEL JOINTS FOR ALL PURPOSES

ASME

(Continued from page 90)

Pros and cons and operating details of the 4000 and 4500 hp units now being developed and tested by the Westinghouse Electric Corporation and the General Electric Company were presented by engineers from both companies. A. H. Morey, project engineer, locomotive engineering division, and R. A. Williamson, manager railroad rolling stock division, discussed the 4500 hp gas turbine freight locomotive now undergoing tests at General Electric's Erie, Pa. plant. Details of the 4000 kw Westinghouse passenger locomotive now under construction were given by W. A. Brecht, transportation engineering manager, and Charles Kerr, Jr., consulting engineer, of the company's East Pittsburgh plant, and T. J. Putz, manager of locomotive and gas turbine engineering at the South Philadelphia works. The speakers listed the advantages of the gas turbine power plant as: burns low cost fuel, is compact, involves mostly rotating apparatus, and offers the possibility of low maintenance. On the other hand, the units have a relatively high fuel rate, require gear reduction for either the standard electric drive or direct connection to locomotive driving wheels, and their output varies considerably with altitude and ambient temperatures.

Rockets

Specifications of a transcontinental rocket-propelled airliner that could cross the U. S. in less than one hour were disclosed to jet propulsion engineers of the American Rocket Society by Dr. Hsue-Shen Tsien, Robert H. Goddard professor at the Daniel and Florence Guggenheim Jet Propulsion Center at the California Institute of Technology. According to Dr. Tsien, such a rocket would weigh 50 tons at launching, of which 37 tons would be fuel load. The ship would be 80 ft long and have a maximum diameter of 9 ft.

In a 3,000 mile flight the liner would follow an initial elliptical path for 1200 miles and then glide for 1800 miles. Altitude at the beginning of the glide would be 27 miles. Maximum velocity would be 9,140 mph, but landing speed would be only 150 mph. Dr. Tsien predicted that the rocket would use either a combination of liquid oxygen and liquid hydrogen, or of liquid fluorine and liquid hydrogen, as propellant.

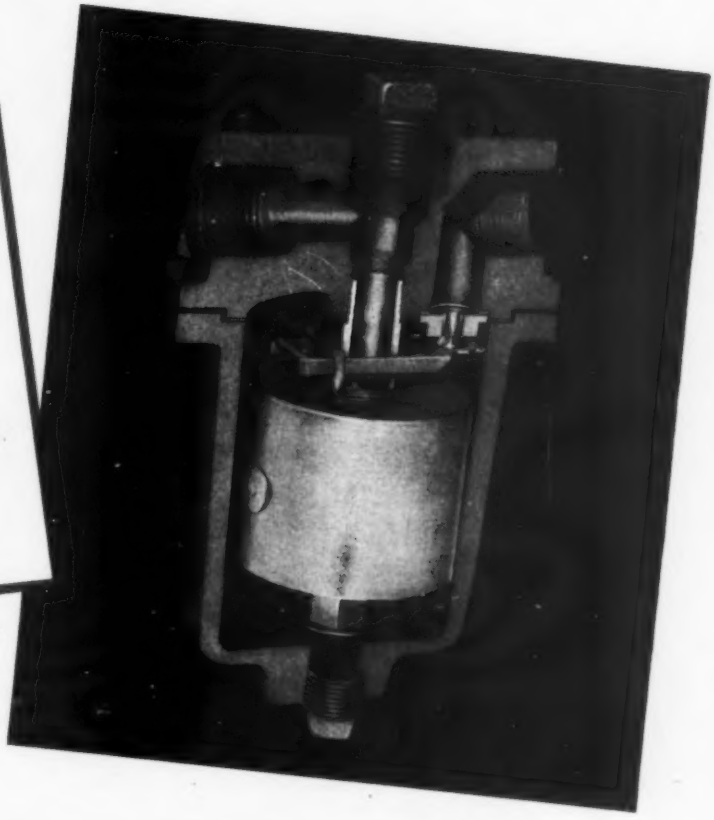
Other Papers

Lack of space precludes complete

(Continued on page 126)

The Inside Story

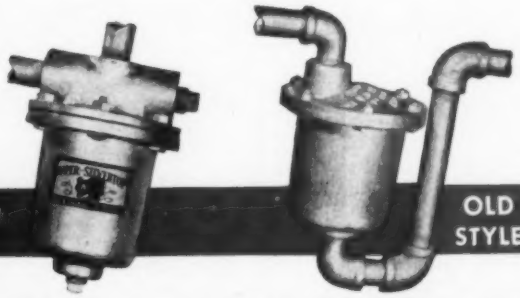
on WHY YOU SAVE *with* SUPER-SILVERTOP Steam Traps



IN THIS CUTAWAY VIEW of an Anderson Super-Silvertop Steam Trap, you can see that all pipe connections are in the head of the trap. The alternate top inlet connection provides for elbow connection, as well as straight-in-line. This means simplified piping, saving up to nine fittings, plus forty minutes of costly installation time over conventional traps! See how the guided bucket permits the use of a longer lever arm with greater valve opening power. This larger valve means more capacity for the same size trap. Super-Silvertop trapping is efficient trapping . . . *the most economical you can buy.*

You save two ways . . . in installation costs and operating costs. Learn how to cut your steam trapping costs. Write for the helpful book, "Solving Steam Trap Problems."

THE V. D. ANDERSON COMPANY
1950 WEST 96TH STREET • CLEVELAND 2, OHIO



USE SUPER-SILVERTOP IN-LINE OR AS AN ELBOW

OLD STYLE

Save Money With SUPER-SILVERTOPS

THE V. D. ANDERSON COMPANY
1950 WEST 96TH STREET • CLEVELAND 2, OHIO

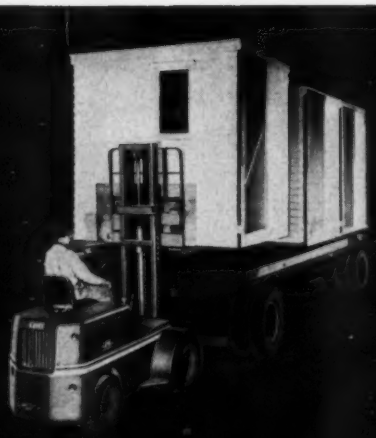
Gentlemen: Please send me a copy of the booklet, "Solving Steam Trap Problems."

Name .....

Address .....

City ..... *State* .....

CLARK



"From placing an Ad-A-Bath to replacing light bulbs—our Clark truck does everything!"

"We use our Clark fork-lift truck for just about everything—from handling a 2000-pound complete bathroom unit measuring 7' x 8' x 8'2", called Ad-A-Bath, to maintenance jobs like replacing light bulbs in our 14-foot ceiling. Two men and the fork truck—equipped with 7-foot extension forks—require only 10 minutes to remove an Ad-A-Bath unit from stock and load it onto a trailer with a roller-conveyor bed. We are well pleased with our Clark fork truck."

Walter K. Taylor, General Manager
BUILDERS MANUFACTURING COMPANY
Division of General Building Materials, Inc.
South Bend, Indiana

It is not alone in the big handling operations that the Clark Method effects big economies—there are innumerable "handy-man" uses that accumulate extraordinary savings of time and money. An easy way to investigate your own opportunities for substantial savings is to CONSULT CLARK.

CLARK ELECTRIC AND GAS POWERED FORK TRUCKS AND INDUSTRIAL TOWING TRACTORS

INDUSTRIAL TRUCK DIV., CLARK EQUIPMENT COMPANY BATTLE CREEK 50, MICH.
REPRESENTATIVES IN PRINCIPAL CITIES THROUGHOUT THE WORLD
AUTHORIZED CLARK INDUSTRIAL TRUCK PARTS AND SERVICE STATIONS IN STRATEGIC LOCATIONS

(Continued from page 124)

coverage of the remainder of the many fine papers presented at the 1949 annual meeting. Some of those which received particular acclaim were: "Performance of the Illinois Smokeless Furnace" by Prof. J. R. Fellows, professor of mechanical engineering, University of Illinois, and J. W. Norris, vice president, Lennox Furnace Co.; "President and Future magnitude of the Pulverized Coal Fly Ash Disposal Problem" by H. S. Walker, director of research, Detroit Edison Co.; "Nitrogen Textroxide as an Oxidizer in Rocket Propulsion" by D. H. Ross, assistant manager, product development department, Solvay Process Division of Allied Chemical and Dye Corp.; "Fiberglas Textiles in Industry" by J. K. Park, manager, textile research and development department, Owens-Corning Fiberglas Corp.; "Modern Concept of Industrial Air Conditioning" by P. L. Davidson, consulting engineer of Philadelphia Pa.; and "Material Handling in Railroad Service Shops" by S. H. Hammond, president, Whiting Corporation.

Annual Dinner

As usual the annual dinner in the Hotel Statler ballroom was a gala affair. W. A. Hanley, vice president, Eli Lilly and Co., served as toastmaster and presidential addresses were given by J. M. Todd, ASME president, and H. J. Gough, president, Institution of Mechanical Engineers of London.

Honors and awards were conferred upon the following: Alfred Noble Prize to J. C. Fisher for his paper, "Anisotropic Plastic Flow"; Pi Tau Sigma Medal Award to P. S. Myers for outstanding achievement in mechanical engineering within ten years after graduation; Richards Memorial Award to A. M. Wahl for outstanding achievement in mechanical engineering within twenty to twenty-five years after graduation; Melville Prize Medal to H. B. Maynard for his paper, "The Role of Scientific Management in World Recovery"; Worcester Reed Warner Medal to F. B. Seeley for outstanding contributions to engineering literature ASME Medal to F. L. Dornbrook for distinguished service in engineering in the research, design, and operation of pulverized fuel combustion equipment; and the Daniel Guggenheim Medal to E. P. Warner for his pioneering in research and a continuous record of contributions to the art and science of aeronautics.

The program was concluded with the introduction of the 1950 council members-elect and the president-elect, J. D. Cunningham, president, Republic Flow Meter Co.

COPPUS "BLUE RIBBON" VENTILATORS

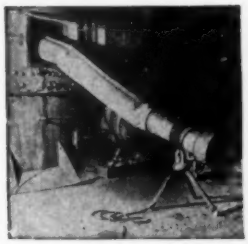
identified by the blue band

FOR WORKERS'

- *Safety*
- *Health*
- *Comfort*
- *Efficiency*

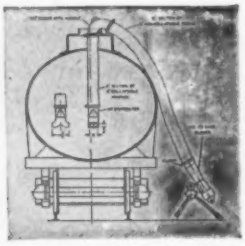
VANO Design "A" VENTILATOR

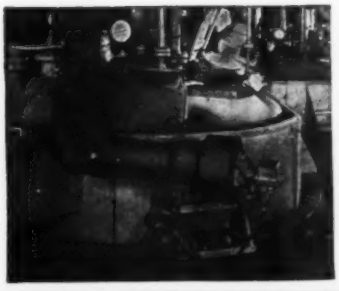
Vano Design "A" cooling interior of furnace, supplying fresh air through 10 feet of "Ventube" to provide safety and comfort during repair work.



Vano Design "A" delivering fresh air to cable manhole, expelling sewer gas, making entrance safe in a few minutes.

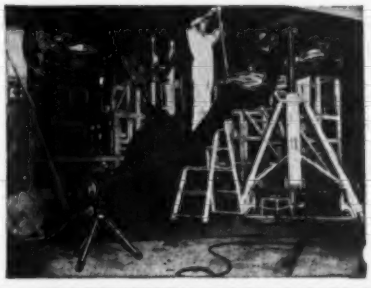
Vano Design "A" Ventilator plus a few accessories feeds large air volume into tank car, driving out fumes, stagnant or hot air for workers' safety and comfort.





Vano Design "A" supplying fresh air in Reactor Room of Synthetic Rubber Plant.

Vano Design "A" Ventilator supplying fresh air to men working in wing compartments, fuselages, etc.



Powered by a ½ hp motor, and equipped with the exclusive Coppus axial-flow propeller-type fan, this general-purpose blower delivers 1500 CFM of fresh air. It supplies ventilation for tanks, tank cars, drums, vats, underground cable manholes, pipe galleries, airplane wing compartments and fuselanes, and other confined places. Weighs only 103 lbs. Uses 8"-diameter flexible canvas tubing ("Ventube").

VANO DESIGN "C" VENTILATOR-EXHAUSTER

Vano Design "C" equipped with 8" discharge tubing removing welding fumes.

Vano Design "C" equipped with two suction lines removing welding fumes for operators' safety.

For withdrawing welding fumes from confined places or directly from the welding rod ... or for expelling fumes or hot air from enclosed vessels. You can get it with 8" suction inlet for 8" non-collapsible tubing ... or with multiple inlet nozzles for 5", 4" or 3" suction hose. The discharge outlet takes 8" "Ventube". Powered by a ½ hp motor, it weighs only 85 lbs.

COPPUS ENGINEERING CORP., 181 PARK AVENUE, WORCESTER 2, MASS.
Please send information on the Blowers that clear the air for Action.

- ☐ in tanks, tank cars, drums, etc.
- ☐ in underground cable manholes.
- ☐ in aeroplane fuselages, wings, etc.
- ☐ on coke ovens.
- ☐ on steam-heated rubber processes.
- ☐ on boiler repair jobs.

COOLING:

- ☐ motors, generators, switchboards.
- ☐ wires and sheets.
- ☐ general man cooling.
- ☐ around cracking stills.
- ☐ exhausting welding fumes.
- ☐ stirring up stagnant air wherever men are working or material is drying.

NAME.....

COMPANY.....

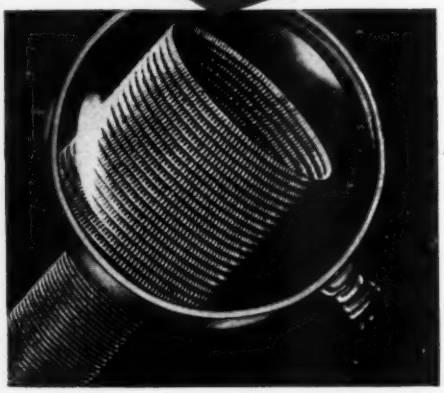
ADDRESS.....

CITY.....

(Write here any special ventilating problem you may have.)

COPPUS "BLUE RIBBON" PRODUCTS—*Designed for Your Industry, Engineered for You*

THE SCREEN IS THE THING



- A good strainer protects your equipment and pipelines. The most important part of a strainer is the screen.
- *Screens* used in Yarway Strainers are made of high-grade monel woven wire having small triangular openings fine enough for required stoppage of dirt, rust and scale, but having ample free area for passage of clean condensate, oil or other fluids. Mechanical strength is greater than ordinary mesh. Perforated screens if desired.
- *Screen cap* is made with straight thread, machined face and spark-plug-type gasket, insuring tight joint. Screen comes out with cap for easy cleaning... automatically aligns when replaced.
- Iron and steel bodies of Yarway Strainers are cadmium-plated for protection against corrosion and better appearance.
- Six sizes, ½" to 2". Hundreds of thousands in use. Stocked and sold by 150 Mill Supply Dealers. See your local supply house or write for Bulletin S-201.

YARNALL-WARING COMPANY
109 Mermaid Avenue Philadelphia 18, Pa.

YARWAY STRAINERS
"Police the Pipelines"

Water Analyses

(Continued from page 99)

um content must be about 50 parts per million or more before complete precipitation of the calcium can be expected under conditions of the test.

References

(1) G. Schwarzenbach, W. Biedermann, and F. Bangerter. Komplexone VI. Neue einfache Titriermetoden zur Bestimmung der Wasser-Harte, Helvetica Chimica, Acta. 20, 811, (1945).

(2) G. Schwarzenbach and H. Ackermann. Komplexone V, Die Athylenediamine-tetraessigsaure, Helvetica Chimica Acta, 30, 1798 (1947).

(3) W. Biedermann and G. Schwarzenbach. Die Komplexometric Titration der Erdalkalien und Einiger anderer Metalle mit Eriochromschwarz. T. Chimia 2, 56 (1948).

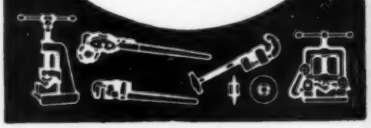
(4) H. Diehl and C. C. Hach, The Schwarzenbach Titration of Total Hardness, Article obtainable from the Hach Chemical Company, Ames, Iowa.

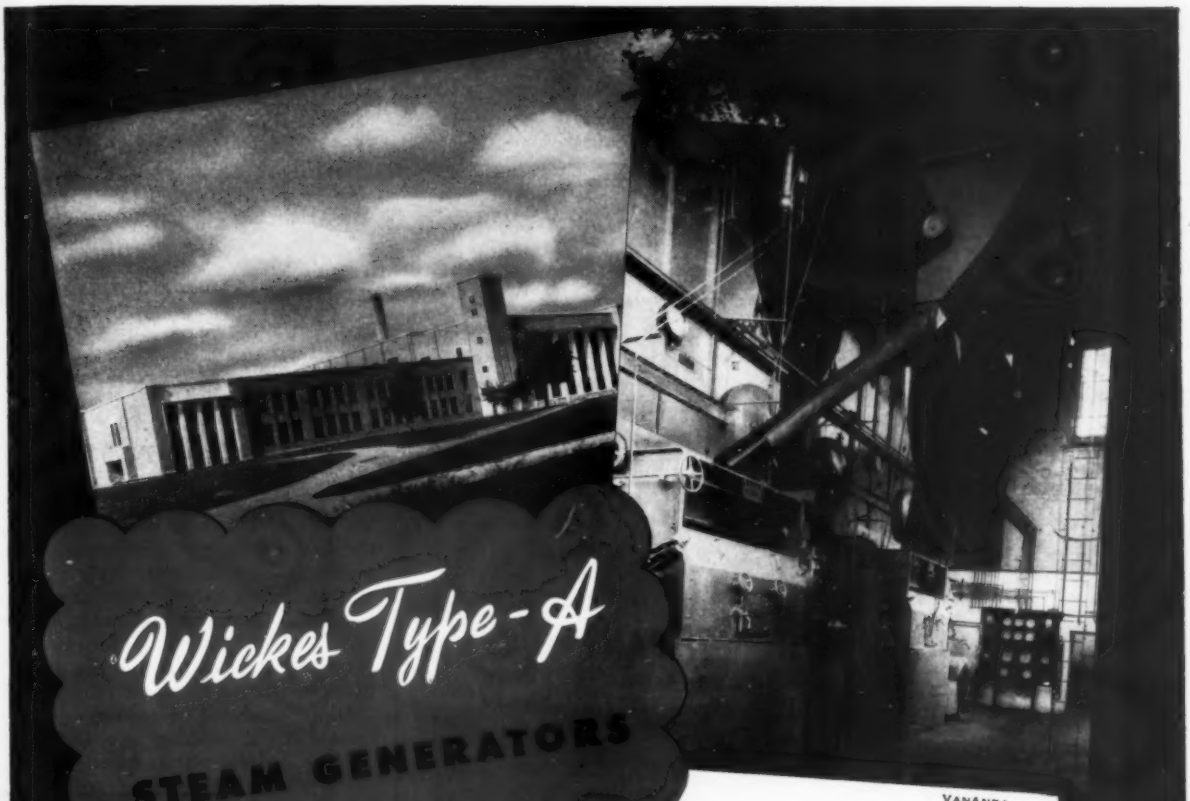
(5) J. D. Betz and C. A. Noll, Total Hardness in Water by Direct Colorimetric Titration, Preprint of Article Submitted to the American Water Works Association, September 16, 1949.

Machined from special alloy tool steel, oil tempered and hardened, ARMSTRONG BROS. Knife Blade Cutter Wheels, penetrate pipe easily, cut smoothly and rapidly, and hold their keen edge. They come in sizes and types for all makes of pipe cutters, and are stocked by leading tool departments everywhere.

Write for the New S-48 Catalog, just released.

ARMSTRONG BROS. TOOL CO.
5237 W. Armstrong Avenue
Chicago 30, Ill.
Eastern Whse. and Sales: 193 Lafayette St., New York 12, N. Y.
Pacific Coast Whse. and Sales Office: 1275 Mission St., San Francisco 3, Calif.





dependable heat for the finest schools

Two Wickes Type-A Steam Generators heat the impressive new 72-room Arthur Hill High School, Saginaw, Michigan and maintain even, healthful temperatures throughout this modern structure for the comfort of 1800 pupils — Wickes water tube boilers, designed for all types of firing, are built to meet every heat requirement and the exacting demands of progressive architects and engineers.

FRANTZ & SPENCE	CHESTER F. MILLER
Architects	Superintendent of
Saginaw, Michigan	Schools, Saginaw, Mich.

WICKES

RECOGNIZED QUALITY SINCE 1854

THE WICKES BOILER COMPANY
SAGINAW, MICHIGAN, U. S. A.
DIVISION OF THE WICKES CORPORATION

SALES OFFICES: Atlanta • Boston • Charlotte, N. C. • Chicago • Cincinnati • Denver • Detroit • Fort Worth, Texas • Indianapolis • Jacksonville • Los Angeles • Milwaukee • New York City • Peoria, Ill. • Pittsburgh • Saginaw • San Francisco • San Jose, Calif. • Seattle • St. Louis • Tulsa, Okla. • Mexico City.

For Dependable FLOW CONTROL

. . . use DAVIS FLOAT VALVES

THE DAVIS NO. 60 FLOAT VALVES

- Single seat; pilot stem.
- Tight-closing; non-sticking.
- Renewable disc; no internal packing.
- Opens easily against any pressure up to 125 p.s.i.

ENGINEERS interested in working out efficient, trouble-free fluid level and flow control hookups will find a wide choice of units offered in the Davis line of float valves, float boxes, and fluid control valves. In addition to all standard designs, Davis has developed many special designs that offer exclusive advantages for specific types of service.

The Davis No. 60 Float Valve, illustrated here, is unexcelled for dependable performance. It handles either hot or cold liquid with no "hunting", no "water-hammering". Built in standard sizes from ½" to 12". Globe or angle body patterns. Ask for Bulletin No. 101 B.

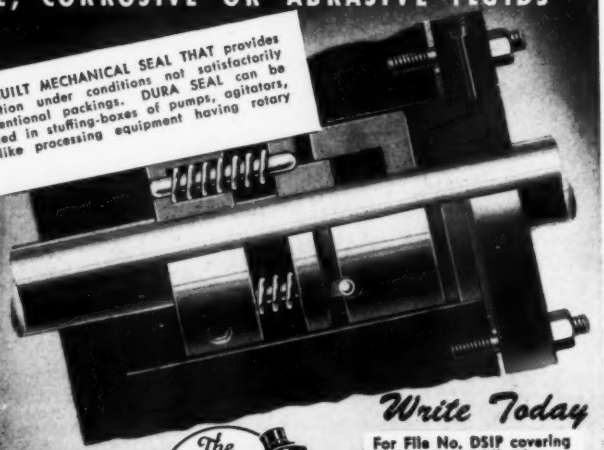
DAVIS REGULATOR COMPANY

2509 So. Washtenaw Ave., Chicago 8, Ill.

DURA SEAL

FOR MEETING THE SEALING REQUIREMENTS OF VOLATILE, CORROSIVE OR ABRASIVE FLUIDS

THE CUSTOM-BUILT MECHANICAL SEAL THAT provides sealing perfection under conditions not satisfactorily held by conventional packings. DURA SEAL can be readily installed in stuffing-boxes of pumps, agitators, mixers and like processing equipment having rotary shafts.



Write Today

For File No. DSIP covering DURA SEAL applications . .

The PERFECT SEAL

DURAMETALLIC CORPORATION

KALAMAZOO MICHIGAN

MANUFACTURERS OF METALLIC and SEMI-METALLIC PACKINGS

ROTARY MECHANICAL SEALS and PACKING TOOLS

Westinghouse Forum

(Continued from page 106)

like any of today's catalog. This, he said, would be a burn-out proof motor. The windings, like the ball bearings of today's motor, will have indefinite life. Moreover it will have built into it complete thermal and overload protection. Starting equipment will be contained within the motor. It will be a packaged drive in the full sense of the term and will require only a foundation, electrical leads to a push-button and power supply, and shaft connection.

Lighting

Samuel G. Hibben, director of applied lighting, lamp division, selected "Light-Yesterday and Tomorrow" as the title of his paper. It describes all the half century of developments of lighting from kerosene wick lamps and arc lamps to modern fluorescent and special lamps we have today. Looking ahead into the next half century, Mr. Hibben stated that lighting scientists can justifiably expect progress to continue unabated. However, a filament material superior to tungsten is unlikely, and, excepting expensive krypton or xenon, little prospect exists for better gases to surround it. High pressure mercury vapor lamps have a hopeful future because their efficiencies are already in excess of 50 lumens per watt and may reach 100 or more. Today's efficiencies of the fluorescent lamp of about 60 lumens per watt, may be doubled in the next decade through better phosphors to provide improved transformation of ultraviolet to visible light, coupled with improved inert gas mixtures within the tubes, and perfected electrodes.

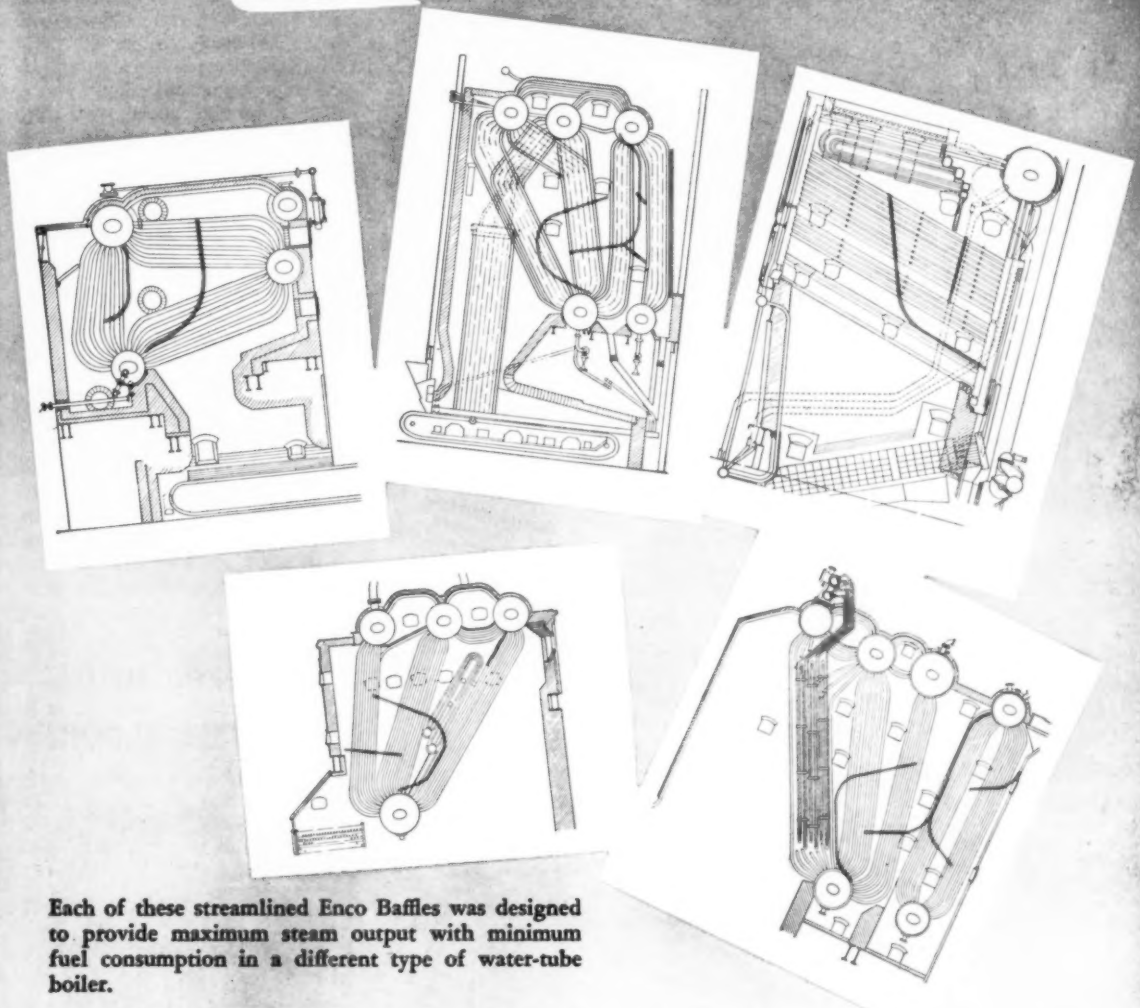
Gains are also possible by the use of higher frequencies. Going from 60 to 400 cycles would increase the luminous output roughly 20% and halve the ballast size. The greatest single factor in man's lifetime is vision, according to this authority. And vision is not at all satisfied with present lighting practices. Estimates indicate that, from the standpoint of greatest economic advantage, today's lighting installations have reached only 25%, approximately, of the optimum quantity and quality.

Electronics

Practical application of electronics, excepting medical X-ray, can be fairly considered as starting with radio only thirty years ago, according to a paper by Walter Evans, vice president, electronics and X-ray divisions. He reviewed the progress of radio, television, power line carrier circuits, radio frequency heating, and radar. Electronics

(Continued on page 132)

Streamlined for Savings
IN EVERY TYPE OF BOILER



Each of these streamlined Enco Baffles was designed to provide maximum steam output with minimum fuel consumption in a different type of water-tube boiler.

Long sweeping curves maintain a smooth cross flow of gases across every square foot of heating surface. Eddy currents, bottlenecks and dead gas pockets are eliminated—draft losses are cut to a minimum. Soot blowers work more effectively, less steam and less time are needed for cleaning.

Enco Streamline Baffles are individually designed and engineered to the exact requirements of your boiler. Experienced Enco-trained crews take charge of the installation.

The 18-page Enco Bulletin, BW44, shows how engineers throughout industry have gotten higher boiler efficiency and increased steam production through the use of Enco Streamline Baffles. Why not write for your FREE copy today?

The Engineer Company Produces:

ENCO OIL BURNERS

ENCO FUEL OIL PUMPING AND HEATING UNITS

ENCO AUTOMATIC OIL-ELECTRIC IGNITION SYSTEM

ENCO AUTOMATIC COMBUSTION CONTROL

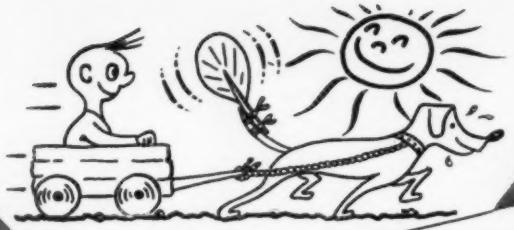
THE ENGINEER COMPANY

75 WEST STREET, NEW YORK 6, N. Y.

Canadian Representative:

F. J. Raskin, Ltd., 370 Rachel E., Montreal, P. Q.

BO-478

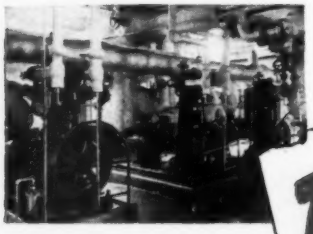


What Other Drive Gives You...

1. BY-PRODUCT POWER

Power to drive pumps, blowers or stokers...auxiliary electrical supply for special needs...off-peak or standby generating capacity—these can be obtained almost free by utilizing the By-Product Power available through Troy Steam Engines.

Steam used for heating or processing packs plenty of horse power as well as B.T.U.s. Under the right conditions, Troy Steam Engines can extract this latent power while actually improving the heat balance. By-Product Power can be converted into A.C. or D.C. electricity by efficient Troy Generating Sets, or it can be utilized directly to drive stokers, fans, pumps, blowers, kilns, compressors, mixers and similar equipment. With the Type EN Governor, constant speed can be maintained accurately; or speed can be automatically varied over an exceptionally wide range.



Double duty: Steam drives high pressure pumps and provides heat for processing in this installation of multiple Troy Steam Engines in the Port Arthur refinery of The Texas Company.

Plus-

2 HIGH STARTING TORQUE

3 UTMOST FLEXIBILITY

4 SIMPLICITY, LONG LIFE

5 ACCURATE, FAST SPEED CONTROL

Which Do *You* Need?

If your drive needs any or all of these five characteristics, the *modern* Troy Steam Engine is indicated. Send us your drive requirements and steam conditions, and our engineers will be glad to recommend the right type and size Troy engine to meet your needs.

Send for Bulletin 306

TROY

Troy Engine & Machine Co.

Power Equipment Division

1201 RAILROAD AVENUE • TROY, PENNSYLVANIA

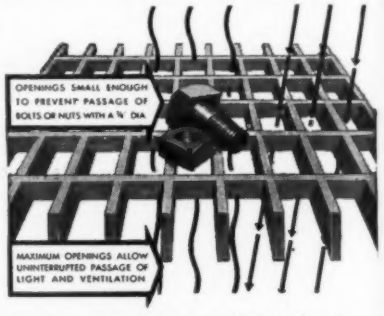
(Continued from page 130)

is still on the steeply rising curve of development, and much can be expected of the research and development work now underway. Apparently no absolute limit exists as to the power that can be generated with tubes. Higher frequencies will increase the usefulness of r-f heating; continued progress can be expected in radio and television; computing and memory tubes will perform complex calculations infinitely faster than can the human mind; and electronic automatic controls will increase the productivity as well as make more attractive working conditions.

Research

Dr. J. A. Hutcheson, director, research laboratories briefly outlined what research has already accomplished. Although hard and fast classifications of research is difficult, such work can be divided into: (1) "get-out-of-trouble" research; (2) improving materials or processes; and (3) developing new knowledge. Currently work is continuing on the atom smasher and much is being done in the study of the behavior of solids at low temperatures—the science of cryogenics. Research, he said, could be likened to a cone resting on its apex. Each new discovery only opens up other questions that demand investigation.

TRI-LOK RECTANGULAR OPEN STEEL FLOORING


OPENINGS SMALL ENOUGH TO PREVENT PASSAGE OF BOLTS OR NUTS WITH A ¾" DIA
MAXIMUM OPENINGS ALLOW UNINTERRUPTED PASSAGE OF LIGHT AND VENTILATION

Tri-Lok strength is obtained by truss action through twisted cross-bar, curved in opposite directions at each bearing-bar. Standard openings in Tri-Lok Rectangular Steel Flooring are 1" x 3⅞"—other size openings can be supplied as required.

Diagonal, or Super-Safety U-type Flooring, and stair treads of all types, are available. Bulletin KD 1140 describes the construction features of Tri-Lok Open Steel Flooring.

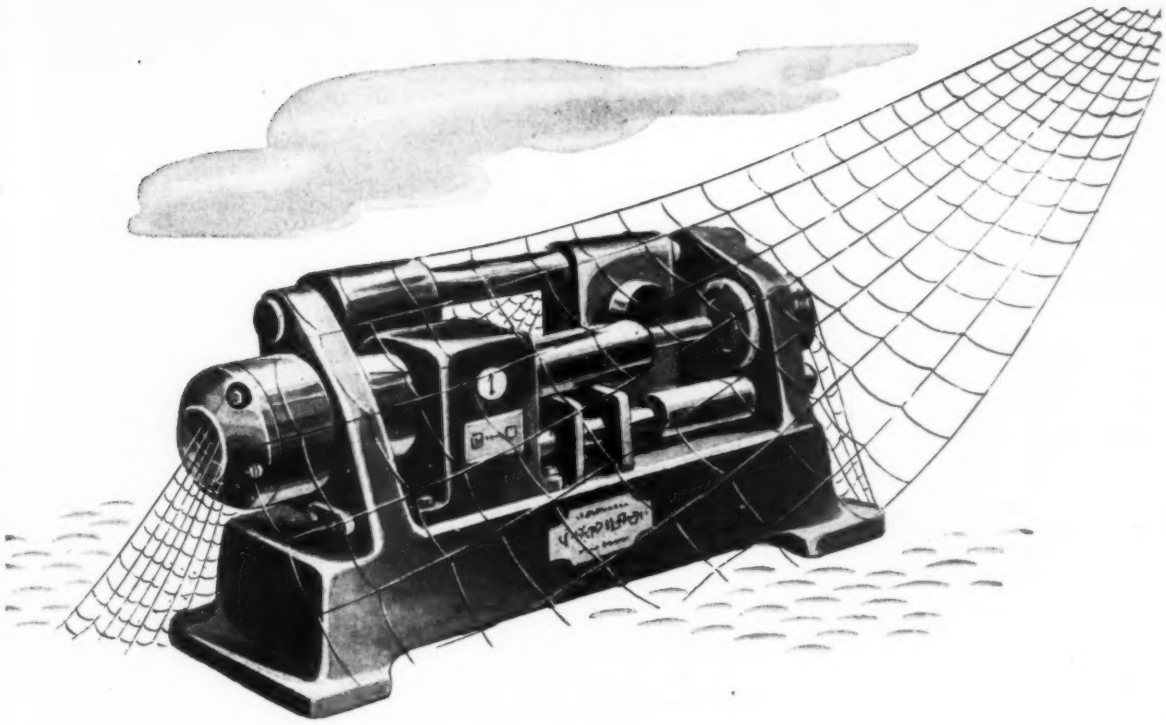
DRAVO CORPORATION

National Distributor for the Tri-Lok Company

Dravo Bldg., Pittsburgh 22, Pa.

Sales Representatives in Principal Cities

DRAVO



HOW MUCH DO YOU GET FOR COBWEBS?

Unless you can sell cobwebs at a mighty fancy price, idle machines cost you money!

The answer? Maximum, *profitable* loading of *all* your machine time with simplified Kardex Sched-U-Graph.

With Sched-U-Graph on the job, mathematical calculations are cut to the minimum. Guess work is *out!* Sched-U-Graph tells you instantly . . . *at a glance* . . .

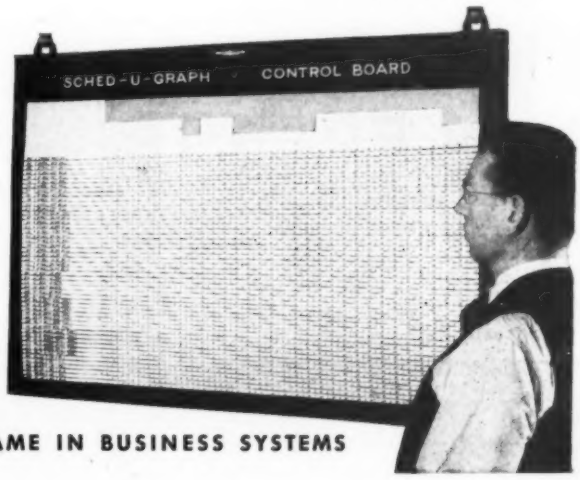
. . . what machines are available
. . . the load ahead of each machine
. . . the jobs making up that load
. . . the scheduled start and finish dates for each job
. . . how much free time is available
. . . when that free time starts and ends

And all this is told, not in a jumble of computations, but in a *clear-cut, graphic, instantly-usable* form that streamlines your machine-loading, puts idle machines to work turning out dollars instead of spider silk! Handles re-scheduling too, to make machine time available for "hot" jobs, or to adjust for breakdowns or operator absence.

Sched-U-Graph is not limited to machine-loading only. Many companies use it to load the time of draftsmen, setup men and others. In fact, *any job performed by man or machine can be scheduled and loaded on* Sched-U-Graph if the time to perform it can be estimated with reasonable accuracy.

Get the whole Sched-U-Graph machine-loading story now and see how it will work for you. Write for your free copy of MACHINE-LOAD CONTROL, KD 320 B, *today*. Address: Systems—Photo Records, *Management Controls Division*, 315 Fourth Avenue, New York 10.

Copyright 1949 by Remington Rand Inc



Remington Rand THE FIRST NAME IN BUSINESS SYSTEMS

THOMAS
Flexible ALL METAL
COUPLINGS
FOR POWER TRANSMISSION
REQUIRE NO MAINTENANCE

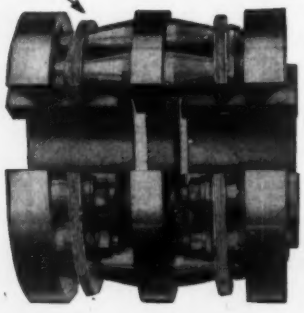
Patented Flexible Disc Rings of special steel transmit the power and provide for misalignment and end float.

Thomas Couplings have a wide range of speeds, horsepower and shaft sizes:
½ to 40,000 HP
1 to 30,000 RPM

Specialists on Couplings for more than 30 years

BACKLASH
FRICTION
WEAR and
CROSS-PULL
are eliminated
Lubrication is not required!

PATENTED FLEXIBLE DISCS



THE THOMAS PRINCIPLE GUARANTEES PERFECT BALANCE UNDER ALL CONDITIONS OF MISALIGNMENT.

NO MAINTENANCE PROBLEMS.

ALL PARTS ARE SOLIDLY BOLTED TOGETHER.

Write for the latest reprint of our Engineering Catalog.

THOMAS FLEXIBLE COUPLING CO.
WARREN, PENNSYLVANIA

BOOK REVIEWS

Heating, Ventilating, and Air Conditioning

Second edition of the "Heating, Ventilating, and Air-Conditioning Fundamentals" by William H. Severns and Julian R. Fellows presents the fundamentals of these three subjects together with authentic data on accepted commercial practice. This revised edition contains the following improvements: (1) rearranged order and enlarged presentation of material; (2) addition of new text material on warm-air furnace heating, hot-water heating, panel heating, refrigeration, air purification, estimating cooling loads, and air-conditioning; (3) design data and methods for hot-water and warm-air panel heating; and (4) design procedure for summer and all-year air conditioning systems.

This book will prove to be invaluable to engineers, architects, and heating and ventilating contractors as well as air conditioning contractors for both phases (practical and theoretical) are discussed. Typical examples are worked out to show the relationship between theory and actual field practice.

Principal chapter subjects include: Essential Definitions, Laws, and Properties of Various Media; Fuels, Combustion, Draft, Chimneys, and Automatic Burning Equipment; Heating Boilers and Appurtenances; Heating with Steam; Heating with Hot-Water; Ventilation and Air Purification; and Mechanical Refrigeration—Applications to Cooling and Heating.

"Heating, Ventilating, and Air-Conditioning Fundamentals" second edition, by William H. Severns and Julian R. Fellows. Published by John Wiley & Sons, Inc., 440 Fourth Street, New York 16, N. Y. Illustrated. 666 pages. $6.50.

Industrial Film Bibliography

Recently published 100 page pamphlet is an up-to-date bibliography of industrial films released in 1947 through 1948. In all 1,400 motion pictures and slide films are listed. This pamphlet has been prepared under the direction of the National Metal Trades Association's committee on industrial training, headed by C. H. Edgar of the Otis Elevator Co.

Pertinent information on audio-visual aids for supervisory and employe training programs are offered. Current bibliography also lists available sound and silent films that can be shown during employe meetings in the metal industry, as well as in industry in general. Each film is described fully and includes the following information: running time; availability; whether black-and-white or color; sound tract or silent; sources from which each film may be bought, rented, or borrowed; and sales or rental charge, if any.

Simplified index locates the film by grouping the subject under such headings as: Cutting and Cutting Tools, Drawing and Blueprint Reading, Lathes, Office Practices, Supervision and Time Study, and Motion Analysis and Methods. A title index is provided also.

Non-members may secure "Industrial Film Bibliography" for $2.00 per copy by writing the NMTA, 122 So. Michigan Ave., Chicago.

Pump Information

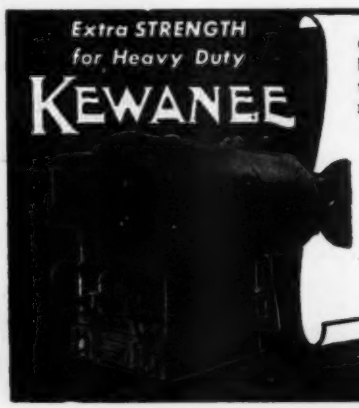
First edition book entitled, "Pump Questions and Answers", contains pertinent information that covers the construction, application, operation, maintenance, and troubles of centrifugal, reciprocating, regenerative, rotary, and vertical turbine pumps. Most commonly asked questions are listed immediately followed by the correct answer and in the majority of instances with an explained illustration.

Text material is concise and insures a clear concept of the principles involved in solving any one particular problem. The material is divided into five sections, one for each type of pump. Each section opens with a general description of the specific type of pump, its component parts, and principle of operation. An analysis of pump characteristics, application, installation, operation, and maintenance follows, with the section being concluded with a thorough treatment of pump troubles, symptoms, and causes.

Included in the section dealing with reciprocating pumps (both simplex and duplex direct-acting horizontal and vertical pumps) entire chapters are devoted to liquid valves, plunger packing, and the analysis of cushion chambers.

"Pump Questions and Answers" by Roy Carter, Igor J. Karassik, and Elliott F. Wright. Published by McGraw-Hill Book Company, 330 West 42nd Street, New York 18, N. Y. Illustrated. 346 pages. $5.00.

Extra STRENGTH for Heavy Duty
KEWANEE



● Backed by more than 75 years of boiler building experience Kewanee Heavy Duty types have all the characteristics which make firebox boilers ideal for high pressure.

10 to 304 H.P.
100, 125, 150 lbs. W. P.

Built of steel with extra stout stays and braces to add further strength.

For 6" Scale with pipe diameter markings . . . WRITE Dept. 96-D1

KEWANEE BOILER CORPORATION
KEWANEE, ILLINOIS
Division of American Radiator & Standard Sanitary Corporation

Smoke Prevention

Papers presented at the forty-second meeting of the Smoke Prevention Association of America, Inc., have been bound in book form and are now available to industry. Twenty-three papers were read at this 1949 meeting and all subjects on smoke were covered. The following is a partial list of papers and their authors:

"Health Aspects of Air Pollution" by A. J. Lanza, M. D.; "Smoke and Fumes Abatement in the Oil Industry" by W. L. Stewart, Jr.; "Operation of Incinerators to Dispose of Municipal Waste" by W. E. Tidmore; "Hot Gases from High Stacks—A Practical Means of Overcoming Objectionable Concentrations or Effluent Gases" by Geo. R. Hill, Moyer D. Thomas, and John N. Abersold; "Prevention of Smoke, Fumes and Solids from Cupola Operation" by Aubrey J. Grindle; "Annual Inspection of Fuel-Burning Equipment" by Chas. W. Gruber; "Comparison of ASME Code for Smoke Emission with Codes of Cities" by Ernest B. Brundage; "Present Status of the Illinois Smokeless Furnace" by J. R. Fellows; "How Effective Committee Work Can Support An Air Pollution Control Ordinance" by Thomas C. Wurts; and "How We Live and Comply with Louisville, Nashville, and Birmingham's Smoke Ordinances" by John S. Swan.

Published by John Paul Taylor, 520 Pleasant Street, St. Joseph, Michigan. 188 pages (8½ x 11). 23 articles. Illustrated. $2.00.

Labor Relations

Information contained in this book gives a clear and concise picture of the Labor Management Relations Act of 1947. Each of the five titles of the statute is discussed. The first title covers the amendments to the National Labor Relations Act. Title II, establishes the federal mediation and conciliation service and procedures for handling national emergency disputes. Title III provides for suits by and against labor organizations. Title IV creates a joint committee of congress to study and report on labor relations problems. While Title V consists of several definitions and a separability provision.

Various types of forms are illustrated with detailed explanations on how they should be properly filled out, when and how to select the correct form for any labor relations problems. Marginal notes brief the paragraph contents and aid in locating information. The appendix is divided into five parts, which includes text of the act, rules and regulations of the NLRB, directory of the board's regional offices, and directory of state mediation agencies.

Important chapter headings are: What the Law Provides; How Unions Comply and Keep in Compliance with Filing Requirements; How to Determine Union's Majority Status; Union-Shop Elections; Jurisdictional Dispute Cases; and How, Where, and When to serve Papers.

"How To Take A Case Before the NLRB" by Louis G. Silverberg. Published by The Bureau of National Affairs, Inc., 1231-24th Street N. W., Washington 7, D. C. 292 pages. Illustrated. $5.00.

with **HOFFMAN**

Heavy-Duty Vacuum Cleaning

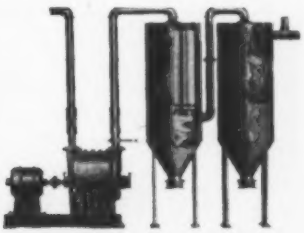
Increased Productivity: Must machines and production workers stand idle while you attempt plant cleaning with old-fashioned methods? Or do you risk breakdowns and rejects while dust, metal chips and dirt accumulate in vital machinery and on production operations? Hoffman *heavy-duty* Vacuum Cleaning enables you to clean on regular periodic schedule, often during plant operations! Flexible tools and powerful suction remove dirt and dust from overhead areas, walls, floors quickly, thoroughly.

Better Quality Control: Is recurrent dust causing product damage—wasting valuable labor and materials? Hoffman Vacuum Cleaning has the answer to a higher rate of successful inspections. In all types of industrial plants Hoffman equipment is contributing to higher quality in the finished products; valuable materials are being salvaged. Let us consult with you on your problem.

Reduced Fire and Health Hazard: Is the nature of your dust sapping your workers' health and efficiency—creating a possible fire and explosion hazard? Perhaps taxing you with excess insurance? Then investigate how you can combat dust effectively, conveniently with Hoffman Vacuum Cleaning. Scores of industries rely on Hoffman equipment for safeguarding their men, machines and material against dust at overall low cost.

Write for Literature NOW!

More than just "cleaning", Hoffman Vacuum Cleaning systems have proved themselves *production tools* that increase and improve production. This new, proved story on vacuum cleaning is described in literature which Hoffman will furnish on request. As specialist in industrial vacuum cleaning, Hoffman builds 4 sizes of heavy-duty portable machines. And stationary systems, in a wide range of sizes, permanently piped, and with convenient inlets for multiple-sweeper cleaning in several locations simultaneously.



AIR APPLIANCE DIVISION

U.S. HOFFMAN MACHINERY CORPORATION

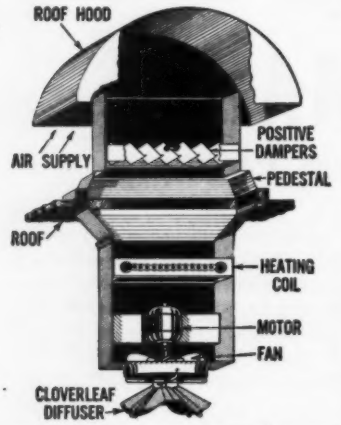
100 EAST 42th STREET, NEW YORK 3, N.Y.

CANADIAN PLANT: CANADIAN HOFFMAN MACHINERY CO., LTD., NEWMARKET, ONT.

TRANE INDUSTRIAL
Weather Magic

Plant hard to heat? Maybe you have a NEGATIVE PRESSURE

The condition of negative pressure which is so frequently found in industrial plants is usually caused by small exhaust fans scattered through the plant for removing wood or metal shavings, dust, smoke, or contaminated air from the building.



Cutaway drawing showing arrangement of parts in Trane Ventilation Heater

Even though this negative pressure is slight, it is enough to draw untempered outside air in through cracks around windows, doors and walls, causing drafts and worker complaints in cold weather.

Trane Ventilation Heaters overcome this difficulty by delivering enough outside air at building temperature to cause a slight positive pressure inside. These same units, in summer, are ideal for supplying ventilation air.

For details, see the new edition of Trane Bulletin DS-364. This bulletin also covers both supply and exhaust types of roof ventilators. Secure a copy from the Trane sales office in your area, or direct from the factory.

THE TRANE COMPANY
LA CROSSE, WISCONSIN

Manufacturing Engineers of Heating, Ventilating and Air Conditioning Equipment—Unit Heaters, Convector-radiators, Heating and Cooling Coils, Fans, Compressors, Air Conditioners, Unit Ventilators, Special Heat-Exchange Equipment, Steam and Hot Water Heating Specialties . . . In Canada, Trane Company of Can., Ltd., Toronto

NEWS . . .

of men and companies

Edwin L. Wiegand Company—Name of the Boston representative has been changed from Howard C. Jones & Associates, 683 Atlantic Ave., Boston 11, Mass. to Leo C. Pelkus & Company. Mr. Pelkus will head the new organization. He is a graduate of M. I. T. and has had many years' experience in the electric heating field, having been with the Howard C. Jones organization for several years. Mr. Jones will remain with the new firm.

Blackmer Pump Company—Stephen C. May has been named vice president and general sales manager of the company, according to B. L. Gordon, president. Mr. May has had extensive contact with petroleum producing and marketing, chemical processing, general industrial and jobbing applications of hydraulic equipment. Mr. May formerly served as consulting sales counselor with the Auto-Soler Company, in sales executive capacities with Pacific Manufacturing Corporation and Iron Fireman Manufacturing Company, and as vice president and sales manager of Darling Valve & Mfg. Co.

S. C. May

P. R. Duffy

The Youngstown Sheet and Tube Co.—Paul R. Duffey, power engineer for the company has been elected a "Fellow" of The American Society of Mechanical Engineers. A native of Roanoke, Virginia Mr. Duffey received his educational training at the Virginia Polytechnic Institute and the University of Cincinnati. He is actively engaged in national and local section activities of ASME and in community affairs. He is a member of the Ohio Society and National Society of Professional Engineers and is a liberal contributor of technical papers.

Laclede-Christy Co.—The company has acquired the capital stock of Diamond Fire Brick Company of Canon City, Colorado, giving it its fourteenth manufacturing unit, of which it now owns eight and is affiliated with six other plants according to an announcement by D. N. Watkins, president. J. L. Cummings has been elected executive vice president, and D. M. Rice of St. Louis has been elected vice president and general manager.

General Electric Company—Appointment of Edward D. Kemble as plant manager of the automatic heating division, and of Leo F. Brown as plant manager of the air conditioning

IT'S EASY TO UNDERSTAND WHY SO MANY USERS NOW *Specify*

WALDRON
GEAR TYPE
ALL STEEL
Couplings

These users want not only a gear type coupling but also a WALDRON Gear Type. They recognize the WALDRON as the most advanced design of the gear type. From a standpoint of shaft size, horsepower, speed and service, comparison with ordinary type couplings make the choice easy. Careful buyers now specify WALDRON—for WALDRON means Gear Type and Gear Type means WALDRON.

• •

For design and construction details, ratings, service factors and other details on the kind of coupling you require, write for our Catalog No. 57

JOHN WALDRON CORPORATION
NEW BRUNSWICK, N. J.
Agents in Principal cities

equipment plant has been announced by F. J. Van Poppelen, manager of manufacturing. Prior to his appointment, Mr. Kemble was plant manager of the Clark Equipment Company's lift truck plant in Battle Creek, Michigan. Mr. Brown was associated with the Houdaille-Hershey Corporation, serving as manager of the Detroit plant from September 1948 and the Jackson, Michigan plant from 1946 to 1948.

The National Supply Company—Appointment of George F. Noltein as director of research of the Superior engine division has been announced by the company. Also announced is the appointment of Harvey W. Hanners to succeed Mr. Noltein as chief engineer. Mr. Noltein, who has a long and successful record as an engineer and designer in the Diesel engine field both in Europe and the United States,

G. F. Noltein *H. W. Hanners*

joined the division in 1927 and has been chief engineer since 1937. Mr. Hanners, who has been associated with the division since 1941, has been assistant to the chief engineer for the past two years.

Announced also is the appointment of Edwin A. Booth as general manager of sales of the Spang-Chalfant Division of the company.

The Swartwout Company—Two appointments have been announced in the power plant equipment division of the company as follows: Robert J. Jones, formerly Philadelphia district manager is now New York district manager, and Richard J. Frost, formerly Philadelphia assistant-district manager, now becomes district manager in the same office. The power plant equipment division with offices at 103 Park Avenue, N. Y. will also function as a factory sales branch office under Mr. Jones.

Nordberg Manufacturing Co.—Six new distributor appointments have been announced by Harry M. Cahill, sales manager, small engine department. Appointments are: Al-Pac Engine & Equipment Co., Seattle, Wash.; Atlantic Engine Supply, Inc., Boston, Mass.; Bolinders Co., Inc., New York, N. Y.; H. G. McKinney & Co., Wilmington, Calif.; Northwest Distributors, Ltd., Vancouver, B. C., Canada, and J. N. Vernam Company, Miami, Fla.

Hyster Company—C. H. Collier, Jr., manager of eastern division truck sales has announced three new industrial truck distributorships: A. & W. Engineering Co. of 2222 N. W. 14th Street Miami, Florida, headed by John W. Fulton, president, and C. H. Scott, vice president, will cover 17 counties

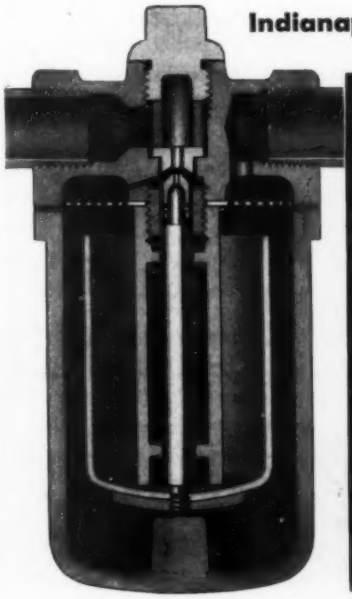
(Continued on page 138)

Keep the STEAM GIANT Under Control for greater production—lower costs

Wherever steam is used in manufacturing and processing, Stickle equipment saves fuel and increases production efficiency far above the cost of the equipment. Sold either as complete systems, or as individual units, Stickle equipment is time-tested, proved for its accuracy, thorough dependability and low maintenance cost. For example, the Stickle Series 100 Steam Trap, illustrated below is ideal for use with Laundry and Dry Cleaning Equipment such as Flat Work Ironers, Drying Tumblers, Dry Rooms, Presses, Collar Ironers, Curtain Dryers, Sleeve Ironers, and Starch Cookers; or, Kitchen Equipment such as Steam Tables, Pressure Kettles and Coffee Urns used in restaurants, hotels and institutions; or, Hospital Sterilizing Equipment; or, Unit Heaters, Jacketed Kettles, Greenhouse Heating Systems and many other applications in chemical and other industries using medium and high pressure steam for drying and processing. Send for bulletin 115 IP describing these traps and for other bulletins on the complete line of Stickle steam systems and specialties. Stickle systems are designed for highest efficiency and lowest operating costs.

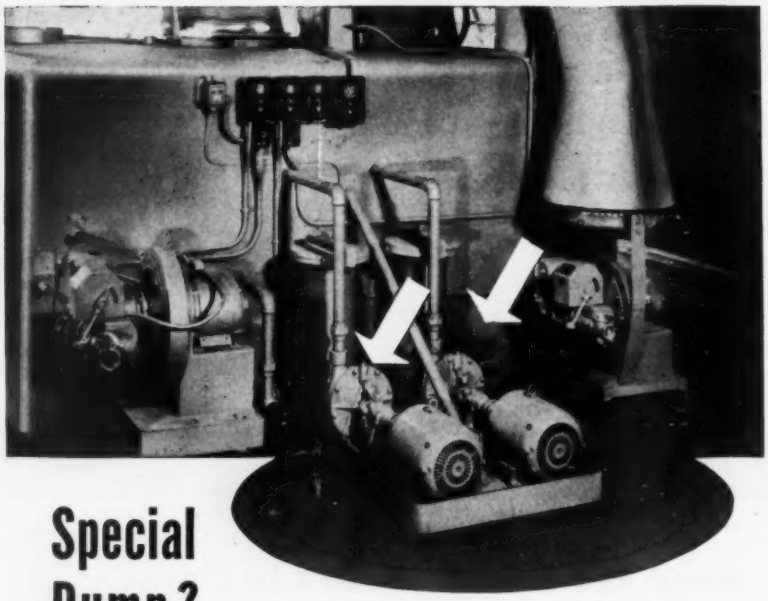
Stickle Steam Specialties Co. • 2227 Valley Avenue

Indianapolis, Indiana



Stickle Series 100 Steam Traps offer many exclusive advantages

- Made in a wide range of sizes.
- Simple, compact construction.
- Completely automatic.
- Self re-grinding valve and seat.
- Straight line installation.
- Open Bucket Float.
- Positive in operation.
- Internal By-pass for air.
- 4 Sizes: 500 to 3000 pounds per hour.
- Operates at pressure from 1 to 250 lbs. depending on sizes.
- Economically priced.



Special Pump?

No! . . . Two STANDARD Deming Centrifugal Pumps work as a team in the compact washing and drying system illustrated. When YOU face what looks like a special pumping problem, take a look at the complete STANDARD line of Deming Centrifugal Pumps. Complete data is available immediately, at no cost to you. Send for the Bulletins you want.

The Deming Company • 527 Broadway • Salem, Ohio

Please send, at no cost to us, the bulletins checked in the list below.

☐ Check here if you want the location of the nearest Deming Distributor.

CATALOG OR BULLETIN NO.	CENTRIFUGAL PUMP BULLETINS
3300A	Self-priming, Centrifugal Pumps. Capacities from 10 to 280 gallons per min.
3900B	Side Suction, Single and Two Ball Bearing Centrifugal Pumps. Sizes: ½", ¾", 1", 1½" and 2". Capacities up to 200 gallons per minute.
4010A	Single Stage, Side Suction, Single Ball Bearing Centrifugal Pumps with separate liquid end construction. Sizes 1" to 10" discharge. Capacities: 10 to 3600 gallons per minute.
4012A	Single Stage, Side Suction, Two Ball Bearing Centrifugal Pumps with separate liquid end construction. Sizes 1" to 10" discharge. Capacities: 10 to 3600 gallons per minute.
4013A	Single Stage, Side Suction, Two Ball Bearing Centrifugal Pumps. Sizes 1" to 6" discharge. Capacities: 10 to 1200 gallons per minute.
4303	"Motor-Mount" Centrifugal Pumps, 63 standard sizes. Capacities from 5 to 650 gallons per minute.
5004	Single Stage, Side Suction, Single Ball Bearing Centrifugal Pumps. Sizes 1" to 10" discharge. Capacities 10 to 3600 gallons per minute.

SPECIAL BOOKLET: *"Facts You Should Know About Centrifugal Pumps and Impellers."*

YOUR NAME .....

COMPANY .....

STREET .....

CITY ..... ZONE ..... STATE .....

Deming Pumps

(Continued from page 137)

in the southern part of Florida; Wrenn Brothers of 220 South College Street, Charlotte 2, North Carolina, will cover the territory comprising all of South Carolina, the southern part of North Carolina, and most of Georgia. A branch office is located at 296 Ivy Street, Atlanta, Georgia; and King and Kringel Machinery Corp. of 2390 S. Delaware, Denver 10, Colorado, headed by K. T. King, president, has been allocated the territory which includes all of Colorado, most of Wyoming, and the western part of Nebraska.

National Electrical Manufacturers Association—C. T. Lawson, vice president in charge of sales, Kelvinator Division, Nash-Kelvinator Corporation has been elected president of the association at the annual NEMA meeting. He succeeds B. W. Clark, vice president in charge of sales of the Westinghouse Electric Corp. C. W. Higbee, manager, Electrical Wire & Cable Department, U. S. Rubber Co., has been elected vice president.

Gamlen Chemical Company—J. W. Himmelsbach, Engineering Sales, has made arrangements to handle the products of the Gamlen Chemical Co. of Pittsburgh, in the Chicago district.

Worthington Pump and Machinery Corp.—Appointment of A. M. Shaw as assistant manager, pump and compressor merchandising division, has been announced by F. J. Whelan, vice president. Mr. Shaw will be responsible for the development of pump and compressor sales to original equipment manufacturers. His activities will come under the supervision of J. O. Glenn, manager of the division.

A. M. Shaw

P. M. Arnall

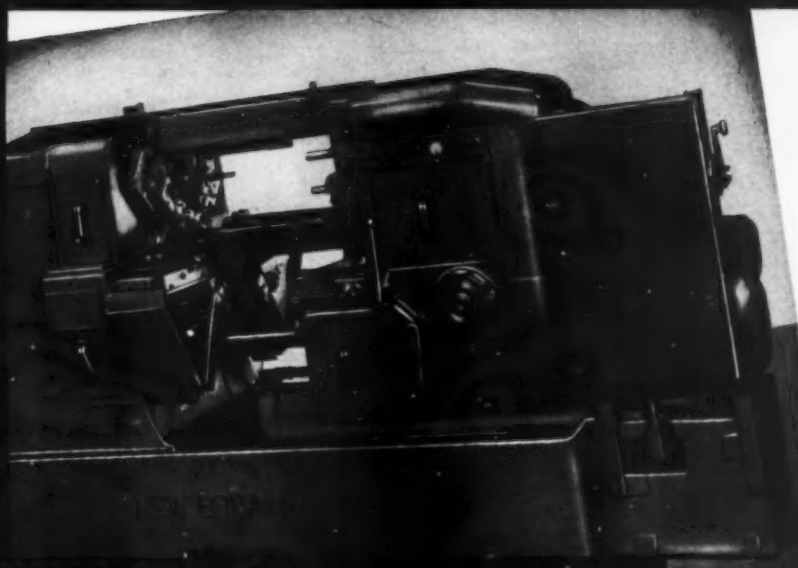
The Lunkenheimer Co.—Announcement has been made of the appointment of Paul M. Arnall as vice president and general manager of the company. This action results from a decision of the board of directors and the management to divide the functions of president and general manager into two separate functions, in order to provide better distribution of top management administrative responsibility. The new management organization will consist of Frank P. Rhame, president; Paul M. Arnall, vice president and general manager; Homer E. Lunken, vice president and assistant general manager; Harry A. Burdorf, vice president, sales; Edmund P. Lunken, vice president; Chester C. Isekeit, treasurer; and Charles W. Burrage, secretary.

Purolator Products, Inc.—Herbert R. Otto, Jr., formerly assistant chief engineer, has been appointed chief engineer according to Jules P. Kovacs, vice president in charge of engineering. Mr. Otto has served in production planning, as plant layout supervisor,

(Continued on page 140)

NEW ELECTRICAL DEVELOPMENTS #5

Prevent Interruptions to *Electrically-Operated* High Production *Machines*



NEW Multiple-Spindle Automatic SCREW MACHINES

Six independently cammed cross-slides are radially arranged about the spindle carrier axis, making possible the same line of forming thrust for every position; minimizing overhang, and allowing you greater interchangeability of holders.

MODERN ECONOMY "De-Lay" Renewable Fuses

here's how to prevent interruptions to high-production machines, due to momentary overloads and "fuse" blows in electrical circuits.

Use ECONOMY "De-Lay" Renewable Fuses, which give safe protection where most overloads occur—in the 135 to 200% range.

Placed in your electrical circuits, ECONOMY "De-Lay" Renewable Fuses prevent many "Blackouts" otherwise caused by current surges lasting only a fraction of a second.

Leading Electrical Wholesalers stock ECONOMY "De-Lay" Renewable Fuses and Renewal Links.

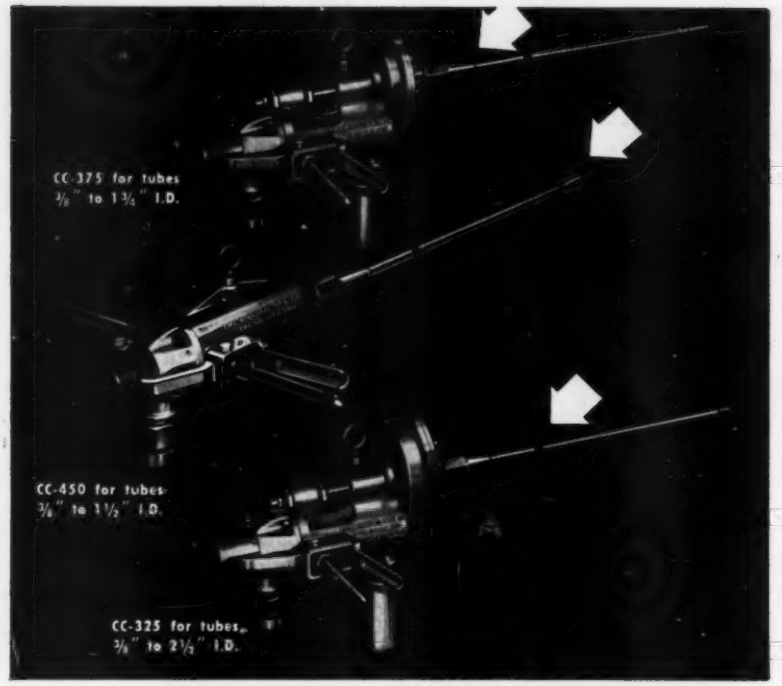
You are invited to write for the New Economy Catalog.

2767

ECONOMY DE-LAY RENEWABLE CARTRIDGE FUSES

ECONOMY FUSE & MFG. CO., 2717 GREENVIEW AVE., CHICAGO 14, ILL. REPRESENTATIVES IN ALL PRINCIPAL CITIES

these Condenser Cleaners



PUT MORE LIFE into small tubes

Stretching the life of small tubes is an AIRETOOL specialty. A clean unit means more efficient heat transfer. The ***right*** cleaning gear plus regular attention assures maximum tube life—minimum maintenance cost—more economical operations.

AIRETOOL outside mounted cleaners are ***right*** for your condenser and heat exchanger tubes. Teamed up with the ***right*** type of drill head, they meet every scale condition. The CB type drill (illustrated) has a carbide metal tip—will remove concrete-hard scale with perfect safety.

CB Drill removes hardest scale even when tubes are completely plugged.

Special features of these cleaners include:

- **handle valve which gives operator quick, positive control.**
- **water feeding device to keep drill head cool and scale cuttings flushed out.**
- **sturdy lightweight alloy steel construction.**
- **powerful air driven motor.**

Insist on AIRETOOL tube maintenance gear. Cash in on longer tube life . . . lower maintenance costs . . . more economical operation. For full particulars write The AIRETOOL Manufacturing Co., 318 S. Center St., Springfield, Ohio.

AIRETOOL
MANUFACTURING COMPANY
SPRINGFIELD, OHIO

There's an AIRETOOL tube cleaner and tube expander for every type of tubular construction.

BRANCH OFFICES: NEW YORK, PHILADELPHIA, CHICAGO, HOUSTON, TULSA, BATON ROUGE. REPRESENTATIVES IN PRINCIPAL CITIES.

(Continued from page 138)

and as methods superintendent, before his appointment as assistant in design and production engineering.

Chain Belt Company—Announcement has been made of the appointment of the McConkey-Docker Co., 126-132 Madison Street, Phoenix, Arizona, Dills Supply Company of 200 Wayne Ave., Dayton 2, Ohio, and the Ryther & Pringle Company of Carthage, New York, as distributors for the chain and transmission, Baldwin-Duckworth, and the conveyor and process equipment divisions.

American Wheelabrator & Equipment Corp.—J. Robert Bunch has been appointed sales representative to assist J. D. Alexander in the Cleveland sales office. He received his formal education at Indiana University, and joined this company in 1936. After spending nine years in various production departments, he has, for the past four years, supervised the erection and servicing of the company's products in the Cleveland area.

Midwest Piping & Supply Co., Inc.—Phil R. Becker has been appointed sales manager of the welding fittings division according to an announcement by A. G. Stoughton, president. The company's executive offices are in St. Louis, with plants in St. Louis, Passaic, N. J., Los Angeles, and Boston. Mr. Becker joined the firm ten years ago and worked for two years in the engineering department on detailing and designing fabricated piping and coils. Since 1945 he has devoted his entire time to sales in the welding fittings division.

The B. F. Goodrich Company—Bernard M. Costello has been named vice president, manufacturing, and William E. Ireland, vice president, sales, of the International B. F. Goodrich Company, according to an announcement by W. C. Gulick, president. The International Company is the foreign trade division of the firm. Mr. Costello comes to his new post after serving as vice president and factory manager of the company's plant in Kitchener, Ontario, Canada for the past 11 years. Mr. Ireland has been with the company 15 years and has been merchandise manager of the International Company since 1947.

Lester, Hankins and Silver—Bernard Lester, formerly assistant manager of industrial sales for Westinghouse, John A. Silver, and Frank W. Hankins have announced the formation of the management engineering firm of Lester, Hankins and Silver. Specializing in the management, distribution, and sales problems of manufacturers and distributors of machinery, equipment and technical products, the company has offices at 1605 Race Street, Philadelphia, and 140 Cedar Street, New York.

The Dampney Company of America—Announcement has been made of the appointment of Industries Service & Equipment Company, 822 West 34th Street, Erie, Pennsylvania, as representative in the counties of Erie, Crawford, and Warren of protective coatings for the maintenance of metal.

NEW EQUIPMENT AND DEVELOPMENTS

(Continued from page 14)

throws the fluid against the sides of the bent channel or passage way and because these slant forward the fluid carrying the solids and trash is driven along the channel. This achieves the pumping action. The diameter of the rotating channel at its narrowest point is equal to the diameter of the inlet pipe; hence almost anything that will enter the eye of the pump will be carried through without clogging. Fairbanks, Morse & Co.

For more information use one of the convenient reply cards on page 37. No postage necessary. Circle the key numbers of items about which you want additional information.

318—SCAFFOLD HAS THREE POSITIONS

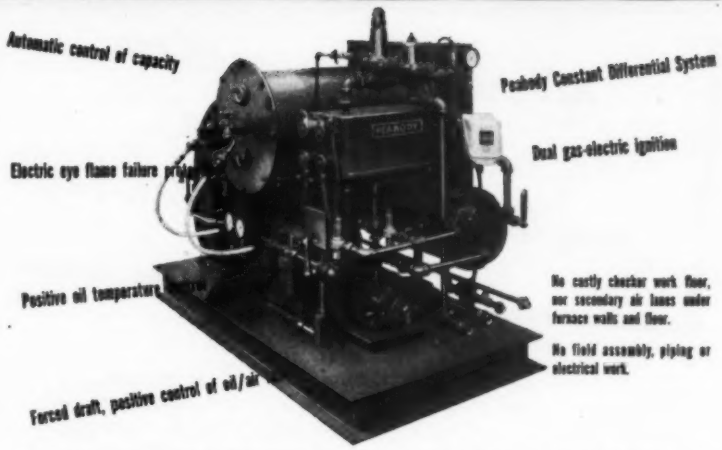
New scaffold with only three parts has a platform assembly with integral, pivotable, extendable diagonal braces which when in use swing into latching position on the underside of the assembly. The assembly is then a flat sandwich only 3 in. thick. Each ladder frame assembly is complete with

adjustable legs and either casters or rubber end cups. In the extended position the diagonal braces provide rigidity to the scaffold when the platform is in the upper position. In the retracted position the diagonal braces can be fastened a distance of one rung below the platform assemble, which provides the maximum of vertical clearance. In either the extended or retracted position the brace is locked by means of an interlock clip. The platform assembly has locking hooks which snap onto the ladder rungs.

now available ~

A COMPLETE, COMPACT Combustion Unit
to fire boilers and furnaces
from 100 Developed HP upwards

PEABODY
Automatic Burner


Automatic control of capacity
Peabody Constant Differential System
Dual gas-electric ignition
Electric eye flame failure
Positive oil temperature
No costly checker work floor, our secondary air lines under furnace walls and floor.
No field assembly, piping or electrical work.
Forced draft, positive control of oil/air

The Peabody Automatic Burner is a complete self-contained combustion system that pumps, heats and burns heavy Bunker "C" or lighter fuel oils. No other auxiliary equipment is needed. Shipped as a complete factory-mounted unit, this new Peabody development eliminates field engineering and special construction. Listed by the Underwriters Laboratories and equipped with all modern safeguards for manual or fully automatic operation.

FREE BOOKLET!

Write for your copy of Bulletin 400 that contains complete details, operating data and other information.

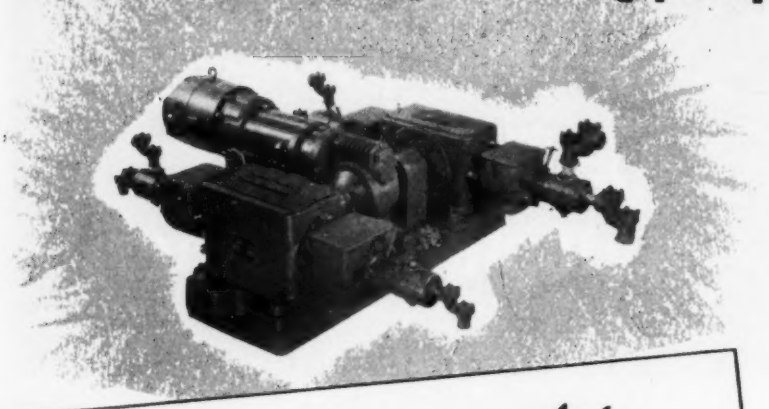
BLAST FURNACE GAS BURNER
REFINERY BURNER FOR GAS AND OIL
COMBINED GAS AND OIL BURNER
COMBINED COAL AND OIL BURNER
DIRECT-FIRED AIR HEATERS
GAS SCRUBBER, COOLERS, ABSORBERS
FUEL OIL PUMP AND HEATER SETS

PEABODY
ENGINEERING CORPORATION
580 FIFTH AVENUE • NEW YORK 19, N. Y.
Manufacturers of all types of combustion equipment, direct-fired air heaters, gas scrubbers, coolers, and absorbers

OFFICES IN PRINCIPAL CITIES

205

Only the new HILLS-McCANNA metering and proportioning pump



offers such complete dependability and freedom from maintenance

THE NEW Hills-McCanna "K" Type Pump offers a whole new conception of metering and proportioning. A simple straight-line enclosed hydraulic drive submerged in an oil bath replaces the complex mechanical linkages found in most pumps. Built-in overload relief makes it impossible to damage motor or mechanism by inadvertant overloading. Horizontal cylinders with twin checks reduce danger of air binding and can be easily disassembled for cleaning without dismantling piping. Stroke may be adjusted quickly and easily, from zero to full capacity, *even while the pump is operating.* Just compare and you'll see why "K" pumps are more dependable and require practically no maintenance.

Hills-McCanna "K" Type Pumps have capacities to 300 gph per feed and pressure ratings up to 25,000 psi. Write for full details. HILLS-McCANNA CO., 2355 W. Nelson Street, Chicago 18, Illinois.

HILLS-McCANNA

metering and proportioning

pumps

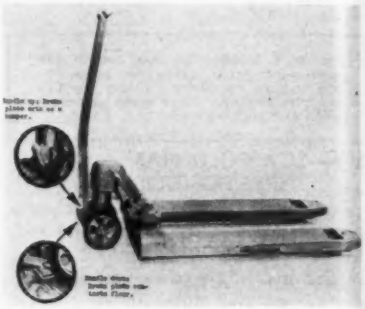
Saunders Patent Diaphragm Valves

Force Feed Lubricants • Magnesium Alloy Castings

The final adjustment of the height of the scaffold is made by the adjustable legs. The 28 in. width permits the scaffold to be rolled from room to room without disassembly and it can be used on stairways by placing one ladder frame lower than the other. Upright Scaffolds Div., Upright, Inc.

319—BRAKE-BUMPER IS NEW FEATURE OF PALLET TRUCK

A combination brake and bumper has been added to the lightweight hydraulic pallet truck manufactured by Lyon-Raymond Corporation. The new device consists of a curved steel plate which is welded to the bottom of the

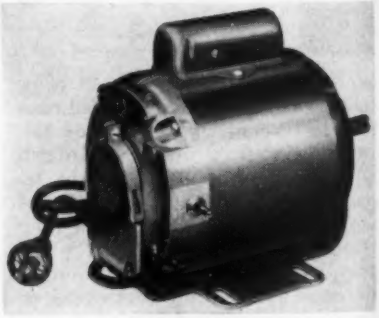


towing handle. When the handle is raised, the plate extends out in front of the truck and acts as a bumper if the truck is run up against a solid object. By holding the handle down, the plate contacts the floor acting as a brake. Greater downward pressure on the handle increases the braking action. It is especially useful for easing capacity loads down ramps.

For more information use one of the convenient reply cards on page 37. No postage necessary. Circle the key numbers of items about which you want additional information.

320—1/3 HP ELECTRIC MOTOR REVERSES INSTANTLY

A single-phase, instantly reversing 1/3 hp electric motor developed by Iron Fireman Manufacturing Company starts in either direction, reverses in-



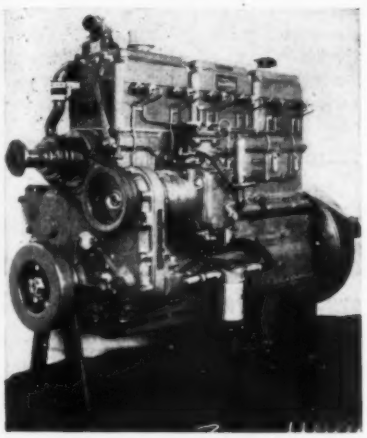
stantly, and may be allowed to stop normally or to stop immediately at the flip of a built-in control switch.

The motor operates much like a three-phase unit. Featured are shielded ball bearings, automatic overload protection, totally enclosed design, resilient mounting, and built-in control switch. This capacitor-start motor has a NEMA 56 frame size, operates on 115 volts, and has a 1725 rpm full-load speed.

For more information use one of the convenient reply cards on page 37. No postage necessary. Circle the key numbers of items about which you want additional information.

321—DIESEL ENGINES HAVE 175 HP AT 2000 RPM RATING

Two new six-cylinder, highspeed Diesel engines have been placed in production by The Cummins Engine Company, Inc. Both have a maximum rating of 175 hp at 2,000 rpm. They are specifically designed for use on



applications where there is a need for the flexibility of higher rotative speeds and the performance of higher horsepower. Features are: (1) fully counterbalanced crankshaft; (2) camshaft of new design; (3) viscous-type torsional vibration damper; and (4) revised fuel pump. Both have a piston displacement of 743 cu in., a 5 1/8 in. bore, and 6 in. stroke.

322—THREE MECHANICAL SEALS AVAILABLE FOR PUMPS

Three types of mehanical seals for centrifugal pumps have been introduced by the Byron Jackson Co. The type U is a balanced, high-pressure single seal installed on shafts from 1 1/8 to 5 7/8 in. and can be adapted to shafts of larger dia. When constructed of corrosion and heat-resistant materials, this type is suitable to service where high temperatures and corrosive liquids are handled at high pressures. The type L is a simple, inexpensive and low-pressure single seal designed for small pumps handling cold water or bulk-station prod-

• The facts are that in many plants the cost of handling chemicals, grains and granular materials is much higher than necessary. This amounts to an additional production cost that could be reduced by using a DRACCO Pneumatic Conveyor. Don't be satisfied with present methods — handling cost is an everyday expense that should be reduced to the minimum. DRACCO Pneumatic Conveyors save money in MANY ways but in most installations the saving of labor is the important factor. Why not consult DRACCO Engineers, they have over 35 years experience and may be able to reduce your handling costs.

For Further Information Write

DRACCO CORPORATION

4046 E. 116th St., Cleveland 5, Ohio New York Office: 130 W. 42nd St.

DUST CONTROL EQUIPMENT
PNEUMATIC CONVEYORS • METAL FABRICATION

ROCKWELL

BUTTERFLY VALVES

for Air · Gas · Liquids · Solids

Whether it's by manual control or remote, automatic control, these valves provide efficient, positive, uniform flow regulation at any desired, visible degree of valve opening. When entirely open, valve area is practically as free as the pipe line itself, without bends or seats to cause undue pressure drop or turbulence.

Construction — of any desired metal. Pipe sizes—to 72". Operating pressures—standard, to 25 p.s.i., special, to 125 p.s.i.

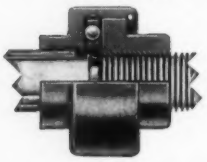
Write for Bulletins

W. S. ROCKWELL COMPANY
230 ELIOT STREET • FAIRFIELD, CONN.

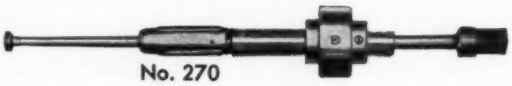
You Get
FASTER–SMOOTHER
Tube Rolling

with IDEAL Tube Expanders

Ball Bearing-Adjustable Thrust Collar



No. 255



No. 270

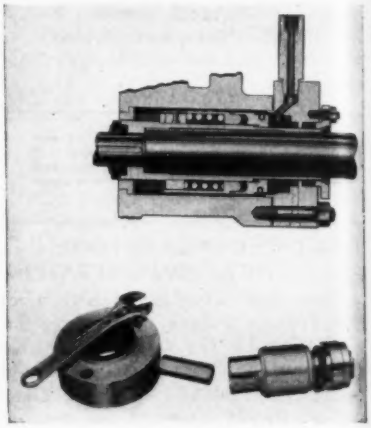
• Loose collar remains stationary against tube end or sheet, reducing friction to a minimum. Prevents pulling of tube and will not mar sheet—specially ECONOMICAL for production work.

Expanders may be adapted for use with Automatic Torque Controlled Operating Units, for precision tube rolling.

For Complete Details . . . see Your Dealer, or Write Today

The Gustav Wiedeke Company
DAYTON 1, OHIO

ucts where temperatures do not exceed 110° F and pressures do not exceed 50 lb sq in. The type B is an oil-lubricated double seal designed for high

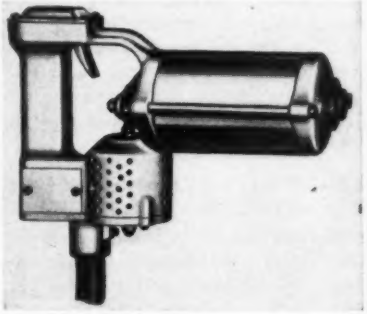


pressures and cold service where pumped liquids contain little, if any, lubricating value. Uses include high pressure product pipe lines where various products, including butane and propane, are pumped.

For more information use one of the convenient reply cards on page 37. No postage necessary. Circle the key numbers of items about which you want additional information.

323—ELECTRIC HAMMER IS SELF CONTAINED

An electric hammer with a 5/8 in. dia drilling capacity is entirely self-contained, with the rectifying unit, heretofore housed in a separate container, now incorporated in the handle casting, so that the operator plugs the hammer cord directly to the 110 v,

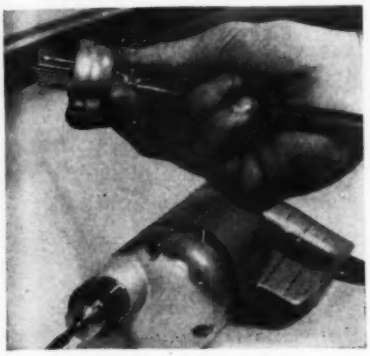


a-c power source. This new development has been made possible by Syntron Company's research development and manufacture of a line of selenium rectifiers, enabling the use of a much smaller and lighter weight rectifier unit that could be included as a part of the hammer proper. The light weight of the hammer together with the elimination of the separate rectifier unit, make it convenient for crews

and others who do the bulk of their work on ladders and scaffolds.

324—OUTLETS OF PLUG-IN STRIP ARE ALL GROUNDED

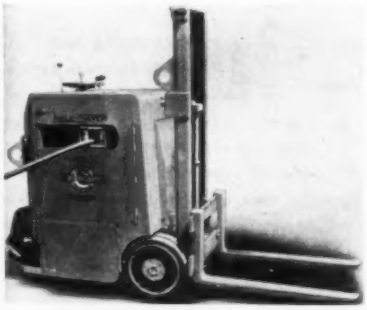
In addition to providing a spread of electrical outlets at either 6 in. or 18 in. intervals, a new multi-outlet plug-in strip assembly offers the opportunity of plugging-in grounded or ungrounded portable electrical equipment in every receptable. Besides the conventional two slots in each recep-



tacle, there is an adjacent third slot. Beneath this aperture is a copper insert that is securely mounted to the multi-outlet's steel base, affording a positive grounding facility. This construction allows the use of a standard 2-blade plug, or the series 5200 3-blade grounding plug. To achieve a thoroughly grounded electrical system, the plug-in strip must be installed with a positive ground to earth. National Electric Products Corp.

325—FORK TRUCK DESIGNED FOR EXPLOSIVE AREAS

An air operated "explosion-proof" fork truck has been developed for use in small or restricted areas where ex-



plosion hazards exist. The truck operates from any air system at 90 lb per sq in. pressure with a consumption of from 200 to 250 cu ft per min. Seventy-five feet of ¾ in. hose on a retracting reel allows full maneuverability in approximately 18,000 sq ft of floor area. The truck is built on the

Have a Double Check on boiler water levels

Avoid time-and-money-expensive low water accidents and near accidents

Prevent boiler outage and expensive water level accidents by having *adequate* boiler water supervision. It's easy to get with the Reliance Safety Team—ALARM Water Column and EYE-HYE Remote Reading Gage. Save your operators hours of time, thousands of steps in their vital job of checking the "life blood of the boilers."

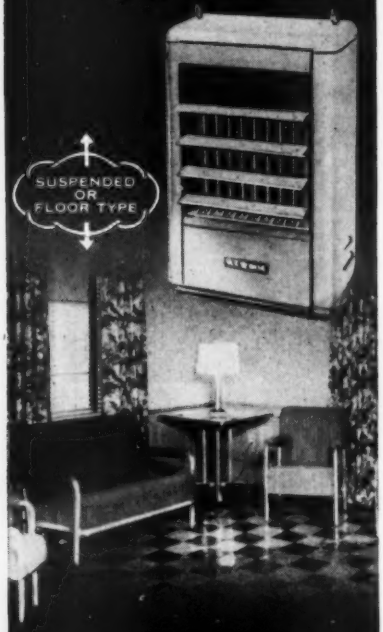
Known the world over for accuracy, sturdiness and dependability, there's a Reliance Water Column for every type of boiler—any pressure—and gage equipment for every water level checking need. Approved by all authorities—specified by leading boiler makers and consulting engineers. Representatives in all principal cities. Write today for more detailed information.

BOILER SAFETY DEVICES since 1884

Reliance®

THE RELIANCE GAUGE COLUMN CO. • 5902 CARNEGIE AVENUE • CLEVELAND 3, OHIO

Automatic
REZNOR
gas fired unit heaters



MORE BOSSES . . .
bought Reznor unit heaters in 1949 than any other make

More offices, factories, stores, garages and restaurants are heated with Reznors than any other make of unit heater. There's a reason. Write today.

- FULLY AUTOMATIC
- EXTRA LARGE FAN
- SPECIAL HEAT EXCHANGER
- STRONGER CONSTRUCTION
- MORE ECONOMICAL
- LOW COST INSTALLATION
- ALUMINIZED STEEL INTERIOR UNIT

Gas Unit Heaters Since 1888

REZNOR MANUFACTURING CO.
11 UNION ST. · MERCER, PENNA.

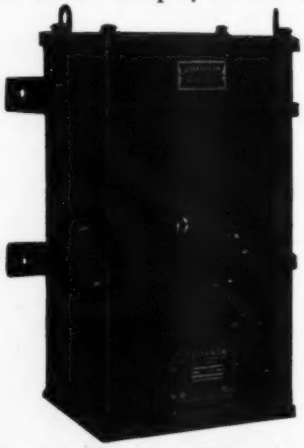
aisle-saver chassis in 2,000 lb and 3,000 lb capacities with variations in lift, over-all height, and fork length, to meet various service requirements. The motor exhaust effects a considerable change of air while the truck is in operation and provides an extra safety factor when the truck is used in enclosed areas. The Crescent Truck Company.

326—SEAT RING WRENCHES MAINTAIN VALVES

Two new steel seat ring wrenches have been announced by The Lukenheimer Company, both of heat-treated alloy steel for maximum strength and wear. When in use the union bonnet ring of the valve acts as a guide, bearing against a shoulder on the wrench, assuring firm engagement with the seat ring being removed or put in place. One wrench has a threaded collar which provides for adjustment on different depth valves and is available in sizes to fit valves from ¼ to 3 in. The other wrench is designed for valves from ¼ to 2 in. inclusive. For use with screw-over bonnet valves which do not have union rings, a bronze retaining ring is provided to hold the wrench in place.

327—LOW VOLTAGE POWER TRANSFORMER IS DOUBLE-WOUND

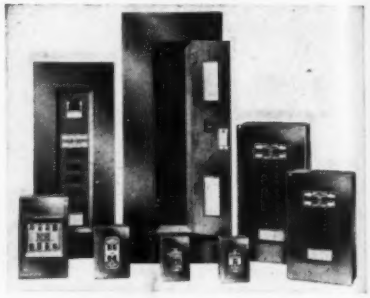
Because of the increase of higher voltages in industrial plants, the Jefferson Electric Company has extended



their power circuit transformer line to include 7½, 10, and 15 kva sizes. The line provides lower voltages for lighting circuits, appliances, small electric tools, relays, and controls. These double-wound transformers are of the dry type with sturdy mounting brackets and loops for hanging. Wiring compartments are provided for both primary and secondary connections with ½ and ¾ in. knockouts. Primary voltage is 460/230, secondary 230/115; 50/60 cycle.

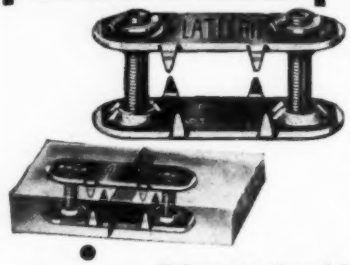
328—MULTI-BREAKER LINE CAN HANDLE 1-42 CIRCUITS

Complete new multi-breaker line to handle from 1 to 42 lighting and appliance circuits has been announced by

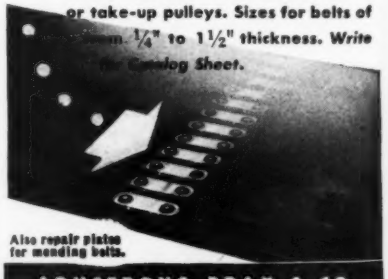


the Square D Company. The MO-8 "ad-on" multi-breaker (formerly known as the MB-4) features the single pole "ad-on" breaker unit for greater flexibility. Starting with a minimum of 4 circuits on the basic device, 4 more single pole circuits can be added to the same box for future

PLATEGRIP
PLATE FASTENERS FOR CONVEYOR BELTS



Make strong dust-tight, water-tight joints in belts of any width. Special design spreads tension uniformly across belt, allow natural troughing of belt and assures smooth operation over flat, crowned or take-up pulleys. Sizes for belts of ... ¼" to 1½" thickness. Write ... Catalog Sheet.



Also repair plates for mending belts.

ARMSTRONG BRAY & CO.
5366 Northwest Highway, CHICAGO 30, U. S. A.

Here's A Better Way To Read Water Levels Of Inaccessible Boiler Drums!

Use New

JERGUSON TRULEVEL GAGES

For All Distant Reading Problems

JERGUSON TRULEVEL Gages are the ideal solution to your problem when you need to read boiler water level accurately at a distant point, as in the case of inaccessible waste heat boilers.

TRULEVEL brings the liquid level reading of water, or of any condensing medium which you may be using, right down where you can see it. Complete accuracy of reading is assured by the use of a new type datum column, located at the drum.

Quick checking at the distant reading point is another important feature of TRULEVEL, and this is patented and exclusive with Jerguson. By simply turning the two valve handles on the cover it is possible to check gage accuracy *in a matter of seconds.* For accuracy and safety use the Jerguson TRULEVEL.

IMPORTANT! *Manometric fluid used in* TRULEVEL *Gage is color fast! Simple to maintain. No leakage. Another important feature of Jerguson* TRULEVEL *Gages.*

Write for Jerguson Trulevel Data Unit No. 38, without obligation, today!

JERGUSON
GAGE & VALVE COMPANY
100 Fellsway, Somerville 45, Mass.
Representatives in Major Cities
Those Listed Under **JERGUSON**

requirements. The MO-12, MO-20, and NMO panelboards are designed for installation where a large number of circuits are required. Flexible "plug-in" multi-breaker units can be applied to round bus bars, in 2 circuit steps, as additional circuits are needed. Wiring has been simplified for quick installation. Separate packages are provided for basic boxes and interiors, covers and "ad-on" or "plug-in" units. Duplicate stocks are eliminated and orders can be "tailor-made" to the customer's specific requirements.

329—BLACK LIGHT GLOWS IN DARK ON NEW GAGE

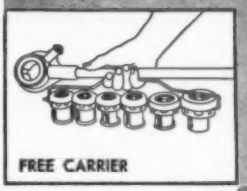
Helicoid Gage Division of American Chain & Cable Company, Inc., has just added to their line a unique illuminated dial gage with black light

that glows in the dark. This instrument is made for flush mounting on a panel, and is symmetrical with other square case instruments. The dial has a black background with ultraviolet phosphorescent pointer, numerals, and graduations, or plain white illumination. Standard dial sizes are 4½, 6, and 8½ in. with the same drilling dimensions as conventional round case gages. The following features are listed as no teeth to wear out; stainless steel bearings; fused joints; steel Bourdon tubes; and an external pointer adjuster.

330—POWER FAILURE CAUSES SHUT OFF VALVE TO WORK

The North American Manufacturing Company has added to its production line a new approved valve designed to protect industrial furnaces against dangerous accumulations of gaseous or liquid fuels in the event of a power failure. This valve stops the flow of any gas or liquid instantly when the current to its solenoid is interrupted. When the power is restored, the valve remains closed until the trouble is corrected, then is reset manually. Any number of switches wired in series with the solenoid can protect the installation against explosion hazards which result from failure

Beaver



No. 3 Ratchet Threader For Pipe, Bolts, Conduit

Beaver No. 3 Ratchet Threader is a deluxe tool with fully-enclosed ratchet teeth that cannot get gummed-up or mutilated—thus eliminating the danger of serious accidents caused by ratchet slippage.

Die segments square in shape—no weak sections—are easily removable for sharpening and can be inverted for close threading. Ample openings between segments for oiling and chip clearance.

Diehead carrier free—enclosed metal tool-box available extra.

Beaver No. 3 threads Pipe, ⅛ to 1"; Bolts, ¼ to 1"; Conduit, ½ to 1"; Brass Tubing, ¾-20; ⅝ or ¾-27 Thread. Also specials.

Write for complete new Catalog No. 49—free! It shows a complete line of hand tools, ⅛ to 12-inch; electric pipe & bolt machines, power drives, etc. Address Beaver Pipe Tools, Inc., 231-301 Dana Avenue, Warren, Ohio, U. S. A.

50 Years of Friendly Service

BEAVER PIPE TOOLS

Coe Drainators incorporate NO MOVING PARTS in their construction which can wear and require replacement.

Air binding is eliminated as large volumes of air and non-condensible gases pass through Drainators with condensate.

Visible indication of operation is afforded in the gauge glass.

There is no variation in heat transfer as Drainator's continuous operation prevents the accumulation of condensate and air. Consistent high efficiency is maintained.

Drainator installations use simple "straight-through" piping. No by-pass or extra fittings are required.

YOU'LL BE WISE TO *INSTALL* COE DRAINATORS

SAVE THESE TWELVE PARTS

The Coe Drainator is unusually dependable in operation and REQUIRES NO BY-PASS.

The installation of the twelve customary by-pass parts shown here is eliminated.

WRITE FOR *DRAINATOR CATALOG*

***The* COE MANUFACTURING CO.**

502 BANK STREET • PAINESVILLE, OHIO

DRAINATOR-THE ADVANCED STEAM TRAP

of air pressure, gas or oil pressure, in addition to general power failure. The valve may be tripped closed manually if desired. It cannot be wedged

or propped open with power off since the resetting handle is independent of the valve stem. Available in sizes from ¾ in. through 6 in., the valve may be equipped with solenoids of 110, 220, 440 v and 60, 50, and 25 cyc.

For more information use one of the convenient reply cards on page 37. No postage necessary. Circle the key numbers of items about which you want additional information.

331—EXPANSION JOINTS ARE NON-CORRODING

A new type of expansion joint that is non-corroding and non-contaminating has been announced by United States Gasket Company. This joint is made of material that is impervious to

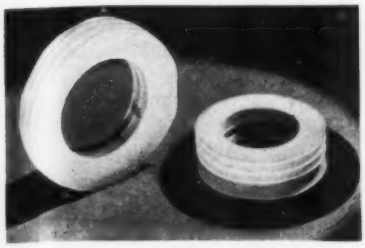
STOKER-VEYOR

A new type conveyor that moves coal from bin to one or more hoppers. Pictured is one being used in the Midland Bldg., Chicago, where its excellent performance has resulted in noticeable economy and cleanliness. Now, they report, they can hold a man on the job. Ask for Bulletin 916.

AMERICAN CONVEYOR CO.

1115 W. ADAMS ST. • CHICAGO 7, ILLINOIS

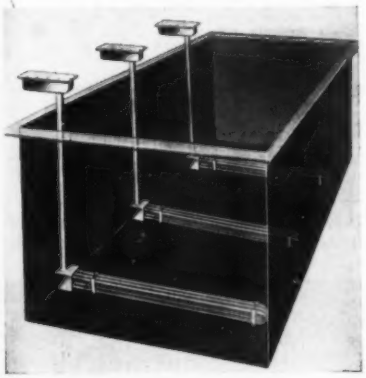
industrial chemicals and withstands temperatures up to 500° F and down to—150° F. The joint is designed for use in applications where corrosion or



contamination is a serious problem. Connectors for installing these expansion joints can be applied to protect the surface that comes into contact with material carried by the piping.

332—IMMERSION HEATER RATED FROM 2 TO 18 KW

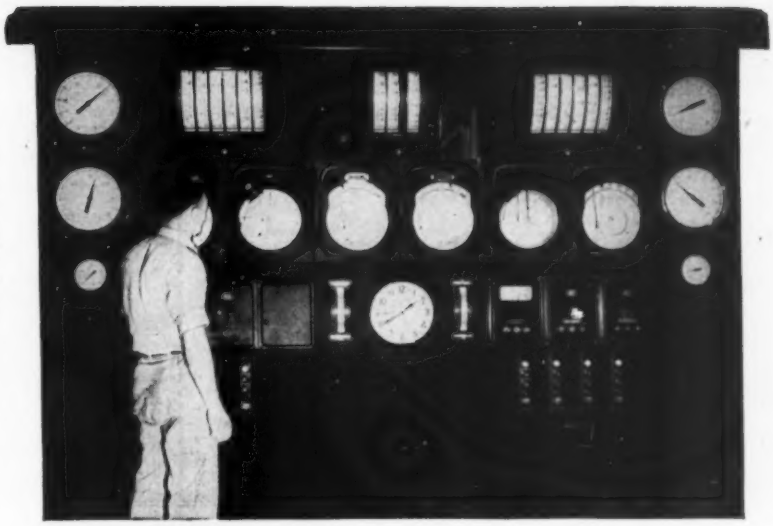
A new portable tank immersion heater for heating oil and water solutions, tar, paraffin, glue, solvent cleaners, and other similar compounds has just been announced. These heaters are rated from 2 to 18 kw, 115 or 550

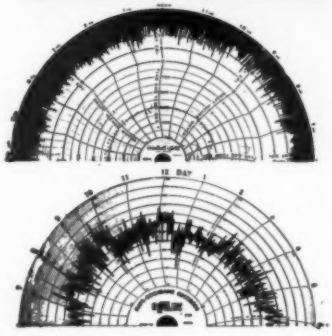


v, single or 3-phase. The heating elements at the bottom of the vertical riser range in length from 12½ to 53 in. in straight sections and can be supplied in circular shape to accommodate usage in round tanks with a minimum opening of 10½ in. The riser can be fabricated in varying lengths to suit any tank depth. The heated section can be had with either two or three hairpin elements. Legs are available for installation to prevent overheating where sludge may accumulate on the bottom of the tank. Edwin L. Wiegand Co.

333—FIRE EXTINGUISHERS HAVE IMPROVED VALVE

For 10, 15, 20, and 25 lb portable carbon dioxide fire extinguishers an improved valve has been announced by Walter Kidde & Company. The valve mechanism employs a pure nickel





optional control—

AT THE FLIP OF A SWITCH

• Brown-Forman Distillers Corporation of Louisville wanted automatic combustion control on their three power plant boilers; but faced a problem in that one boiler is fired with coal mixed with wood waste from the cooperage plant, when available—otherwise with coal alone. The wood waste, varying from saw dust to coarse hog fuel, is not adapted to automatic control—therefore the control system must provide for easy change-over from automatic to manual operation.

• Hays operation solved this problem instantly: full automatic operation when burning coal alone—manual operation for burning wood and coal; and only a flip of a switch to change from either method to the other—no complicated linkages to disconnect, no time lost. An average of 70 percent efficiency is maintained, CO_2 averages 12 to 14 percent and the stack is clear.

• If you are seeking to improve steam plant efficiency and reduce fuel costs, look well at this truly modern system. Talk over your combustion needs with Hays engineers—good men to consult. No obligation, of course. In the meantime write for Publication 47-605—you'll find it exceedingly helpful.

THE HAYS CORPORATION • MICHIGAN CITY 2, INDIANA

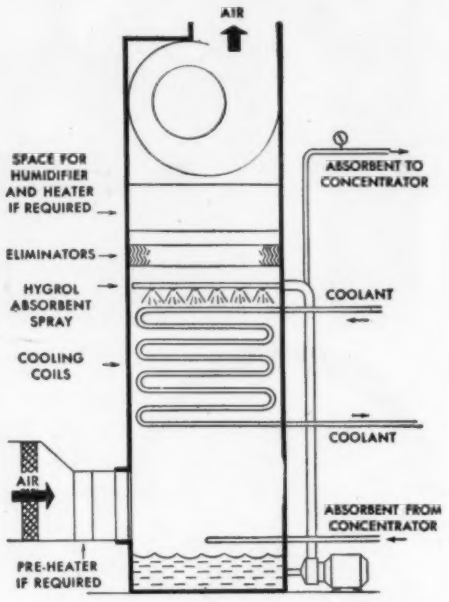
HAYS Automatic COMBUSTION CONTROL

INDUSTRIAL INSTRUMENTS · INDUSTRIAL CONTROL · FLOWMETERS · GAS ANALYZERS · DRAFT GAGES · CO₂ RECORDERS

New Method Gives Precise Control in Air Conditioning

Niagara "Controlled Humidity Method" Uses Hygrol, Hygienic Liquid Absorbent

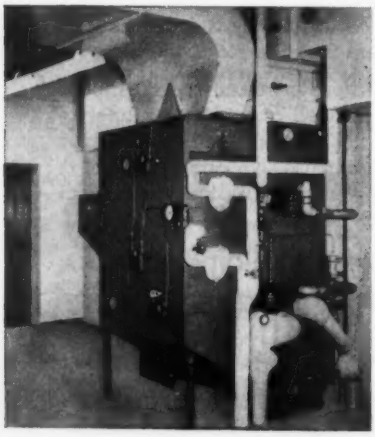
● The Niagara "Controlled Humidity Method" is a new system of air conditioning giving complete control of temperature and relative humidity, holding constant conditions or varying them at the will of the user. Especially, it provides dry air at normal atmospheric temperatures with little or no refrigeration required. A condition of 15 grains of moisture per pound of air at 85 deg. F. dry bulb temperature has been produced without refrigeration.



NIAGARA CONTROLLED HUMIDITY METHOD — FLOW DIAGRAM

The apparatus is enclosed in a casing thru which the air is drawn by fans. The air is filtered and then enters a chamber where it is dehumidified in passing thru a spray of "Hygrol" Liquid (a hygienic hygroscopic chemical that absorbs the air-borne moisture and contains no salts or solids to precipitate). In the same chamber are located cooling coils which remove the latent heat of evaporation and also sensible heat as required.

The absorbent liquid spray falls into a tank at the base, where it is piped to a concentrator, removing moisture taken from the air. The re-concentrated liquid returns to the system. This process is continuous, and the apparatus operates at full capacity at all times.



The same equipment may be used to provide winter air conditioning when required, by installing a tempering coil at the outdoor intake, an humidifier, and a reheat coil above the eliminators.

This equipment is manufactured in a range of sizes providing from 1000 to 20,000 CFM of conditioned air from a single unit, and mutiple unit installations are practical. It is expected that, by reducing the need for refrigeration, the cost of air conditioning will be reduced by this method. Applications generally are in a temperature range from 35 deg. F. upward. Below the freezing temperature of water, the Niagara "No-Frost" method is applicable.

The equipment is protected by U. S. and foreign patents. Installations have been made in food and chemical process industries, in packaging hygroscopic products, for preventing condensation of moisture on metals and other products in storage, in air conditioning for laboratory control and for human comfort.

For further information, write Niagara Blower Company, Dept. IP, 405 Lexington Ave., New York 17, N. Y.

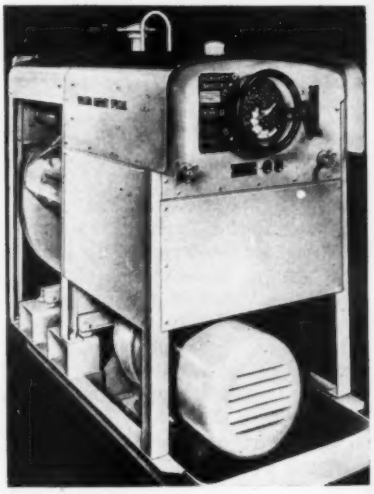
coined disc which serves as a seat for the nylon check, as a safety disc, and as a gasket between the valve body and the cylinder. Extinguisher cylinders used with the new valve are externally threaded to facilitate assembly and disassembly, and to eliminate the possi-

bility of cylinder neck stretching. Trigger of the new valve also provides an automatic warning should the safety disc rupture from excess gas pressure. Rupture of the disc pushes the trigger downward to bring the words "replace disc" in view.

For more information use one of the convenient reply cards on page 37. No postage necessary. Circle the key numbers of items about which you want additional information.

334—200 AMP ARC WELDER IS MACHINE DRIVEN

Air Reduction Sales Company has announced the latest addition to their line of arc welding machines, the 200 amp arc welder. This machine combines the

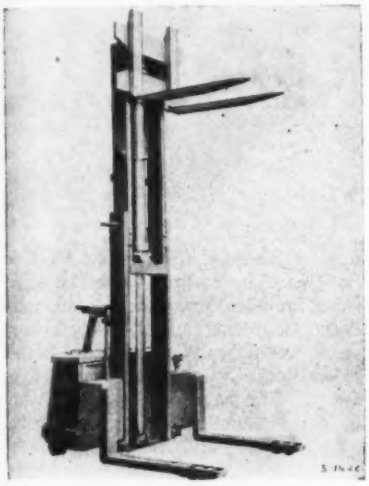


compact 36A generator with a four-cylinder, 31 hp, air-cooled Wisconsin engine. The generator has a welding range from 40 amp at 20 v to 250 amp at 40 v and is built as a two-bearing unit. Closely spaced precision bearings provide maximum load safety. Double

shields keep bearings dirt-free and hold grease in. The five position hand control wheel mounted on the panel shows accurate current markings—readily obtained by setting the pointer located in the center of the wheel. The arc welder is 58½ in. long, 25 ⅝ in. wide, 47 in. high and weighs 825 lb and is equipped with a full-length dripproof canopy. A lifting eye is provided on top.

335—TRUCK LIFTS AND TIERS LOADS UP TO 4000 LB

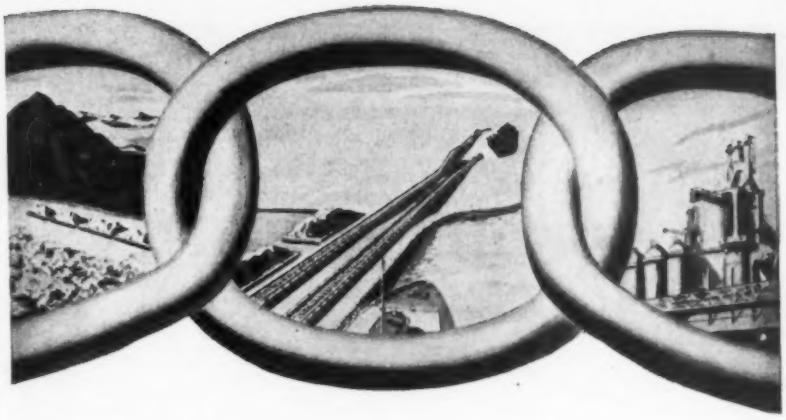
The Yale & Towne Manufacturing Company has announced a new straddle-type electric fork-truck which has power travel and will lift and tier pallet loads weighing up to 4,000 lb. Heavy bar-steel frame members,



equipped with tandem load wheels, sustain these heavy loads without deflection. While originally designed for use with wing-type pallets, this new truck can also be equipped with permanent or removable steel plate platform and remote hoist control for use as a power-travel, portable elevator or stacker. The truck has an articulating frame construction using two swivel wheels forward which provides stability and, at the same time, insures adequate traction through the power drive wheel on uneven floor surfaces. Extremely short over-all length provides short turning radius for operation in close quarters.

336—HANDWHEEL VALVE IS CONTINUOUSLY CONNECTED

The new Hammel-Dahl continuously connected handwheel control eliminates the necessity of the conventional by-pass installation. A globe valve, the same body size as the control valve, has been installed in the by-pass to permit manual operation in case of air failure, or in case the control instrument fails to operate. The handwheel,



Now *Steel* forms a mighty link . . . uniting the two Americas

North America needed additional sources of iron ore to feed her hungry blast furnaces. South America had that ore. For example, up the Orinoco River valley, in Venezuela, there is a huge mountain of it.

Which brought up the problem: how to assure a smooth flow of that ore from the valley of the shallow Orinoco to the waiting blast furnaces oceans away. Getting it 200 miles down the river was relatively simple—it came in flat-bottom barges. But transferring the ore to ocean-going vessels—and seeing that there was always an abundant supply on hand—was a problem calling for skilled engineering.

Hewitt-Robins was called in. Soon, a huge ore storage and trans-shipping station will be in busy operation. Long lines of speeding Hewitt-Robins belt conveyors will take the ore from the barges and neatly stack it in huge storage piles—piles that will reach an eventual capacity of 1,066,000 gross tons (more than *two billion* pounds). As the ocean-going vessels arrive, their 24,000-ton holds will be filled in a brief eight hours by other Hewitt-Robins belt conveyors.

Thus, the ample ore supplies of the southern hemisphere will fill the hungry blast furnaces up north . . . to form a link of steel uniting the two Americas.

This great ore-handling project is another example of a difficult materials-handling problem solved by Hewitt-Robins. It typifies how the three Hewitt-Robins industrial divisions work closely as a unit: Robins Engineers, designing and engineering; Hewitt Rubber Division, supplying the conveyor belting; Robins Conveyors Division, providing the conveyor machinery.

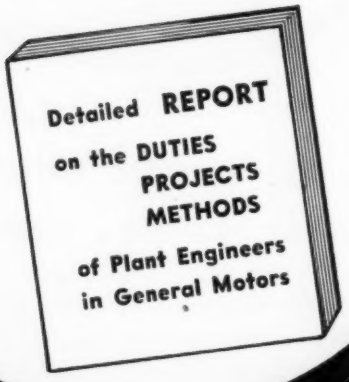
* * *

The services and products of these three divisions are available—separately or collectively—to help make your operations more effective and economical.

HEWITT-ROBINS
INCORPORATED

ROBINS ENGINEERS, 157 CHAMBERS ST., N. Y. 7, N. Y.
HEWITT RUBBER DIVISION, BUFFALO 5, N. Y.
ROBINS CONVEYORS DIVISION, PASSAIC, N. J.
HEWITT RESTFOAM DIVISION, BUFFALO 5, N. Y.

Did you miss this SPECIAL OFFER?



A VALUABLE GUIDE NEEDED BY EVERY PERSON IN YOUR PLANT WHOSE JOB IS A PART OF YOUR PLANT OPERATING PROCEDURE

The most important function in your plant is plant engineering! It's the key to efficient, cost-cutting operation whether your plant is small or large. That's why this timely report is so vitally important to you. It contains basic, factual data and information that you can easily use in your own organization. Each article is carefully written with that direct, "how-to" approach that you can understand fully with the first reading. The information is sound and proved in actual practice because it describes the careful coordination and skillful performance of plant engineering responsibilities at General Motors. Here are some of the articles included in this comprehensive report:

- Plant and Works Engineers of General Motors
- Plant Engineers Committee of GM Gets Results
- Electro-Motive's Steam Plant is Tops in Modernity
- Good Industrial Ventilation Requires Good Management
- Records Keep GM Power Plants on Their Toes
- Cadillac Develops Standards for Preventive Maintenance
- Efficient Material Handling Requires Cooperation
- GM Diesels at Grand Rapids are "Out-in-Front"

You'll want a copy of this complete report, beautifully bound in its four-color cover, for each person in your plant who has a voice in determining plant operation procedure or who has a part in carrying out plant engineering responsibilities. The price is only 50¢ per copy.

READERS' SERVICE DEPT., INDUSTRY AND POWER, ST. JOSEPH, MICHIGAN

Please send me_____copies, at 50¢ each, of the "Report on Plant Engineering in General Motors".

Your Name_____

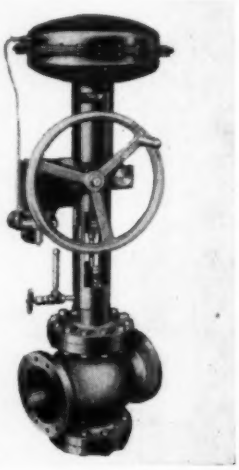
Company Name_____

Company Address_____

City_____ State_____

☐ Please bill ☐ Payment enclosed

built integral with the all steel superstructure of the control valve is strong enough to operate the control valve manually, regardless of maximum instrument air pressure on the diaphragm or in opposition to the spring. It is possible to position the valve plug by hand under any conditions, by merely

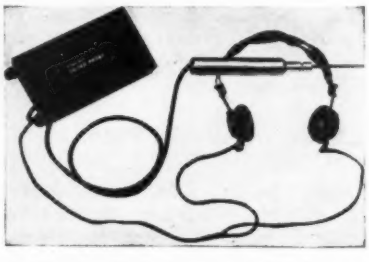


turning the handwheel to the required position. The control valve characteristics are the same whether an automatic or hand control. Travel limit stops are incorporated and can be set to limit the valve stroke from 0 to 100%. The valve plug position indicator automatically shows the valve plug position, and the setting of the travel stops. Also the indicator shows when the handwheel is in a neutral position.

For more information use one of the convenient reply cards on page 37. No postage necessary. Circle the key numbers of items about which you want additional information.

337—SOUND PROBE CONTROLLED ELECTRONICALLY

A completely redesigned sound probe utilizing the principles of electronics localizes sound electronically

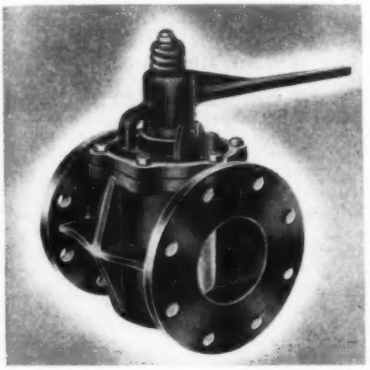


bringing it to a focal point. Amplification of the sound immediately reveals its true character whether normal or foreign and can be accurately traced to its source. The sound probe

brings out a natural reproduction of noise greatly amplified and without distortion. A particular noise in a motor or bearing can not only be heard but can be identified because all foreign or built-up sounds are absent. The electronic sound probe is so sensitive that the tick of the finest watch is clear and distinct. Como-Tex Co.

338—PLUG VALVES ARE EASILY OPERATED

Hand, gear, and cylinder operated plug valves, manufactured by the De-Zurick Shower Co., are opened and closed in one quarter turn and permit ease of operation with a minimum of

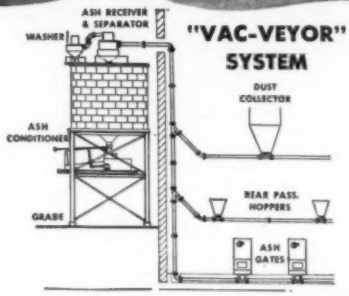


friction, binding, and seizing. The plug face has an eccentric raised seat and contacts the valve body only when in the closed position. When in the totally opened position liquids flow straight through the valve body. Working pressure for iron, bronze, and other alloy bodies for ¾ to 2½ in. pipe sizes is 150 psi; 4 to 8 in., 125 psi; 10 and 12 in., 100 psi; and 14 to 20 in., 75 psi. Valves with rubber faced plugs are limited to 200° F service, while standard metal faced valves are usable to 400° F.

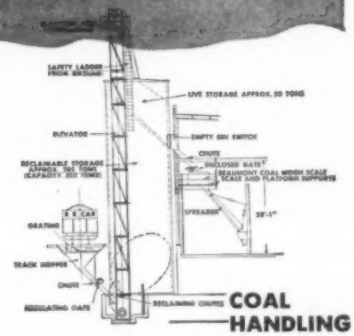
339—AUTOMATIC FIRE ALARM OPERATES LIKE A CLOCK

A newly perfected automatic fire alarm mechanically built and operated like a clock has been placed on the market. The mechanism, copper plated to prevent rust and prompt operation at the time of a fire, is assured for a life time. The device is completely automatic and a special fuse releases the alarm the moment the temperature in a room rises above 133 degrees. Once this alarm is installed on the wall or ceiling of a building it requires no attention and no electricity, so there is no upkeep cost or danger of power failure. The alarm is 8½ in. sq, the mechanism being contained in a red and white plastic case. An 8 in. steel bell gives out a loud clear gonging sound for 5 min. once a fire starts. The Fyr-Fyter Company.

Profits Saved AT EVERY STAGE
. . . WITH BEAUMONT
COAL & ASH HANDLING EQUIPMENT

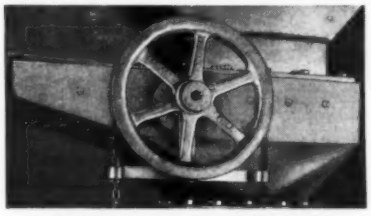


In this system, ashes, siftings, soot and dust are conveyed by pipe from the ash pits, dust collectors, stack, etc., to an ash receiver and separator at the top side of a silo—by means of a vacuum. One man operates the system, keeping your plant cleaner with less labor.



COAL HANDLING

Coal arrives by rail, is dumped into hopper, raised by bucket elevator and discharged either into bunker for immediate use or down chute to yard storage. One operator controls all equipment.



ROLLER BEARING GATE

Incorporating double rack and pinion for granular or powdered materials, these drip-proof self-cleaning gates will not corrode, bend or warp. Material cannot collect in back of gates—these ball bearing gates operate manually or electrically without strain or ramming.

AUTOMATIC WEIGHING SCALE

Accurately weighs coal and similar materials from 1 to 60 tons per hour. Vibrating feeder plate eliminates belts, pulleys and motors. Scale is totally enclosed, dustproof and quiet.

DRAG SCRAPER SYSTEM

Coal is dug evenly with minimum power consumption. Tail blocks can be slung between posts and moved by hand, mechanically moved on I-beam track by tail block car, or suspended from aerial bridge system. One man can operate entire system by remote control.

ASH HOPPERS AND GATES

Steel plate ash hoppers are low cost, rigid, unbreakable, watertight and, when lined with refractory material, resist temperature and erosion. Ash gates are designed for use on stoker and pulverizer ash hoppers where water sealing and draining is essential.

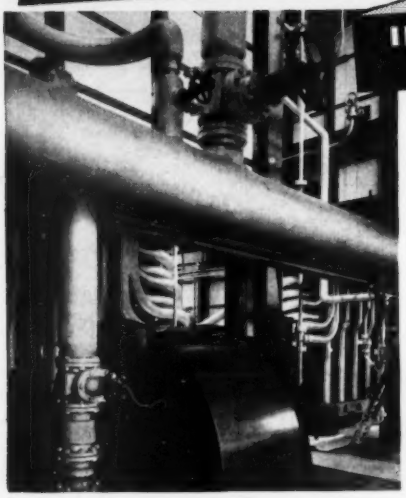
Beaumont engineers design and erect this and associated equipment—*a complete coal and ash handling system.* You save in installation as well as in handling. ONE CONTRACT—ONE RESPONSIBILITY—FOR BULK HANDLING SYSTEMS. Write for more information to:

BEAUMONT BIRCH Company
1509 RACE STREET—PHILADELPHIA 2, PENNA.

Designers Manufacturers Erectors BULK MATERIAL HANDLING SYSTEM

CONTROL SCALE AND CORROSION

IN POWER PLANT EQUIPMENT!



CONTROL SCALE and corrosion in boilers, steam and condensate lines, water jackets, condensers—wherever water is used—with Wright Water Conditioning Chemicals.

There is a Wright Field Engineer near you who will be glad to help you with your scale and corrosion problems. No obligation.

Wright CHEMICALS

WRIGHT CHEMICAL CORPORATION

Specializing in Water Conditioning

GENERAL OFFICES AND LABORATORIES: 635 W. LAKE ST., CHICAGO 6, ILL.

Offices in Principal Cities

SOLE DISTRIBUTOR OF NELSON CHEMICAL PROPORTIONING PUMPS

PICK YOUR WEAPON

HEAT! CHEMICALS! PRESSURE!

PALMETTO SUPER HEAT

...TAKES ON ALL COMERS!

This all-service flange and joint sheet packing takes gruelling punishment . . . won't go to pieces when it runs into chemicals, when pressures or temperatures get rough. Structure does it — selected long-fibre asbestos pressure bonded with special heat and chemical resisting bonding agents. Compressible. Resilient. Exceeds Navy and Federal specifications. Standard sheets and gaskets to order.

Write for bulletin SP-19—the single sheet with Palmetto's eight perfect answers to all sheet packing and gasket requirements.

GREENE, TWEED & CO.

NORTH WALES, PENNSYLVANIA

Contact your fully-stocked Palmetto distributor on all packing problems . . . ask him about our special tools.

NEW BULLETINS

(Continued from page 16)

To obtain any of these free booklets circle the corresponding number on one of the convenient post cards on page 37.

liquids are described and illustrated in a new four-page bulletin. The degasifier is for portable or stationary use. Details of construction are included in the bulletin. Bowser, Inc.

Cooling Tower (Q) Containing hints on operating and maintaining water cooling towers, a sixteen-page booklet is now being distributed. Procedure for putting tower into service, inspection, lubrication, checking efficiency, and partial or total shutdown is given. C. H. Wheeler Mfg. Company.

Water Conditioning (R) Concisely outlined in an attractive 8 page bulletin just printed are the products, services, and back-ground of this company. Bulletin explains the scope of activities in the field of research in water conditioning for boiler plant, process work, and general industrial and municipal use. Illustrations show some of the large installations of hot-process and zeolite softeners, demineralizers, clarifiers, and filters. Graver Water Conditioning Co.

ELECTRICAL EQUIPMENT

Capacitor Motors (S) Complete discussion on two types of single phase motors—capacitor-start and capacitor-start and run—is contained in a new 12 page bulletin. Construction features are illustrated, and specifications and characteristics are thoroughly explained. General Electric Co.

Electric Heater (T) An almost endless variety of standard electric heating units, many of them entirely new, are listed in the new catalog of industrial electric heaters just published. Four basic units—strips, rings, tubulars, and cartridges—with wide variations in wattage, voltage, and sheath material are listed, as well as easy selection and application data. In addition there is shown complete assembled heating equipment. Edwin L. Wiegand Company.

INSTRUMENTS, CONTROLS, RECORDERS

Pressure Gages (U) Illustrations and descriptive matter, pertaining to features and operation principles of this company's pressure gage, are contained in a new 16 page catalog. The movement of the delicate working parts is thoroughly explained. Outline dimensions are included along with several listed gage accessories. Helicoid Gage Division, American Chain & Cable Co., Inc.

Electronic Control Case Studies (V) Forty-five case studies are presented in a pocket size booklet that covers the application and operation of electronic controls. The booklet, entitled "Cutting Production Costs with Electronic Controls" will be invaluable to engineers desiring information on how the electronic control can be adapted to count, guard, sort, weigh, measure,

maintain liquid levels, and countless other tasks. Photoswitch Incorporated.

Draft Control (W) Installation instructions, troubles and their remedies are included in a well balanced bulletin. Full page drawings for sequence draft control, field wiring, typical field wiring-stoker and oil burner, and internal wiring are valuable information. Also full page photographs show different installations. Shallcross Controls, Inc.

Thermometers (X) Complete data on liquid-in-glass industrial thermometers is presented in an easy-to-use tabular and sectionalized form in a new bulletin just published. Graphic pages illustrate all basic models, sizes, forms, and attachments with simplified application data to enable the user to select the proper thermometer for any industrial installation. Precision Thermometers and Instrument Co.

MATERIAL HANDLING

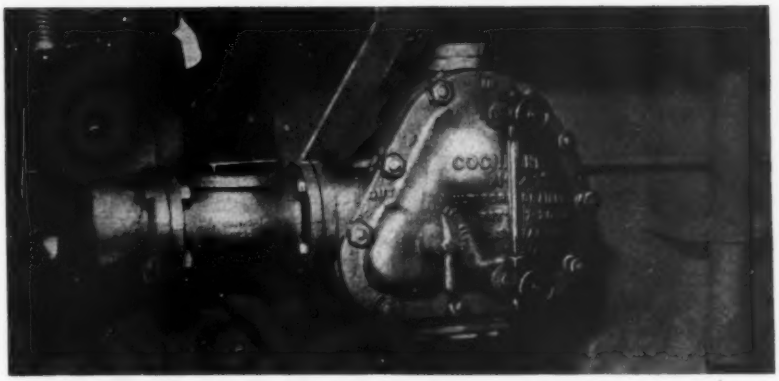
Freight Elevators (Y) Ten illustrated sections in 44 page booklet explain the basic considerations involved when selecting freight elevators and necessary component parts. Subjects covered are: how to determine lifting capacity and size; types of elevator control systems; how to determine door operation method; standard freight elevator layouts; how to determine the type of elevator best suited to needs; budget price information; and typical and special installations. Westinghouse Electric Corp., Elevator Div.

Lift Truck Attachments (Z) Just released 28 page catalog describes attachments, tools, and accessories designed to lower cost and increase ease of handling materials with lift trucks, straddle trucks, and mobile cranes. Model views, diagrams, specifications, action pictures, cartoons, and explanatory text are employed to bring out various special-purpose feature additions to basic material handling machines. Hyster Company.

Pneumatic Conveying (AA) Principal component parts that make up a pneumatic conveying system are explained and well illustrated in a new 24 page bulletin, just released. Numerous field installations are shown and described that cover a wide field of material handling. Fuller Company.

Coal Handling (BB) Announcement has been made of a new bulletin that contains descriptions of 14 case histories of coal handling and storage systems. Installations—based upon one of four basic types of storage and handling systems—and how each unit may be economically adapted to suit varying conditions of space, capacity, climate, and allowable initial cost are explained. Cross sectional drawings and essential engineering data on each of the 14 case history installations are included. O. S. Tyson & Co., Inc.

Blast Cleaning (CC) New bulletin on the redesigned airless abrasive blast cleaning machine is now available. Pictures and diagrams explain the construction and specifications of this exceptionally large, well built machine for handling heavy blast cleaning jobs. Machine has an operating load capacity of 30 cu ft and employs



For quick drainage of large quantities of low pressure condensate, the Cochrane Multiport Drainer is without parallel. This continuous flow steam trap has an extraordinary discharge capacity. The valve opening is determined by the height of water in the float chamber. The larger the volume of water, the larger the valve opening. The valve never leaves its seat and is self-cleaning. The entire mechanism of the drainer is accessible and can be lifted out after removing casing cover. Inlet is at top of drainer, preventing binding—baffle prevents water hitting float.

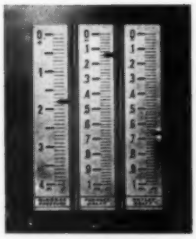
For complete details write for Publication 4340. Cochrane Corporation, 3108 N. 17th Street, Phila. 32, Pa. In Canada, Canadian General Electric Company, Ltd., Toronto.

87 YEARS OF SERVICE

COCHRANE MULTIPORT DRAINER

(Continuous Flow Steam Trap)

Sure they look good—
but it's what's inside that counts!



With over half a century of experience and hundreds of installations you can be sure Ellison Gages are good ***through and through.***

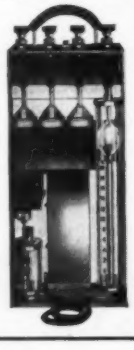
STRAIGHT LINE POINTER DRAFT GAGES

Diafram type, stationary and marine use. A high power, free floating pure silk diafram with a travel of .25 to .75, a displacement 8.4 to 17.5 cubic inches at 1" pressure. Request Bulletin 24-B. Bell type, stationary use, 2½" travel—Bulletin 22. Translucent glass scales and labels.

INCLINED DRAFT GAGES

Ellison Inclined Gages with upward inclined tube. No oil in tube over scale at zero, .2" oil head, constant zero with wide room temperature changes. Level and Tube replaced in field. Request Bulletin 9-F.

GAS ANALYZERS



Combustion testing set available with necessary equipment for the analysis of CO_2, O_2 and CO—complete with Flue Gas Thermometer. Request Bulletin 20-F.

ELLISON DRAFT GAGE CO.

Since 1896

214 W. KINZIE ST. CHICAGO 10, ILL.

THE ELLISON LINE ALSO INCLUDES:

Dial Draft Gages—Bell Type • Inclined Draft Gages—Portable • Inclined Vertical Tube Gages • Vertical Tube Gages—Oil, Heavy Liquid and Mercury—Single and Multi-Tube • Saturator Gages • U Gages—Stationary and Portable • Air Filter Gages—Dial and Inclined Tube Types • Pilot Tubes • U Path Steam Calorimeters • Portable Gas Analyzers—Orsat Type.

ELLISON INSTRUMENTS—Outstanding Design, Construction and Accuracy

ROTOJET has the POWER to make tough tube cleaning jobs EASY

Power is the stuff that makes the new ROTOJET stand out from all other tube cleaners. It makes tough jobs ridiculously easy. Uses less air, too. Get a powerful, rugged ROTOJET, and no other cleaner will ever satisfy you. Air or water-driven models for practically any size straight or curved tubes.

ROTOJET Air-driven Motor Model 525 with swing-frame head and universal joint for 2⅝" to 3" I.D. curved tubes.

ELLIOTT COMPANY-ROTO DIVISION

156 Sussex Avenue Newark 1, N. J.

two wheel units to blast steel forgings, gray iron, steel, and malleable castings as well as heat treated products. American Wheelabrator & Equipment Corporation.

Magnetic Separator (DD) Illustrated 8 page bulletin describes electric and non-electric magnetic pulleys, non-electric magnetic drums, triple pole rectangular magnets, lifting magnets, non-electric plate magnets, high intensity induced roll and cross belt magnetic separators, and other equipment. Data includes brief specifications, lists of applications, and equipment features. Dings Magnetic Separator Co.

Airless Blast Cleaning (EE) Bulletin complete with pictures, drawings, specifications, and details of construction, and operation of a new airless blast cleaning machine is available. Described is the unique combination of tumbling and longitudinal travel of the work by which the machine offers thorough cleaning and uninterrupted efficiency. American Wheelabrator and Equipment Corp.

Slings and Fittings (FF) Numerous tables of data and dimensions, on different types and sizes of slings and fittings for various applications, as well as drawings for each type fill a 105 page catalog. Fittings for slings, sizes of turnbuckles, safety, suspension, and crosby clips are also illustrated. One section is devoted to attaching wire rope sockets. In the back of the book is a numerical list of slings and an alphabetical index. Bethlehem Steel Co.

POWER TRANSMISSION

Silent Chain Drive (GG) New catalog features simplified selection of silent chain drives in three easy steps: (1) apply safety factor, obtained from table, to hp rating; (2) refer to "selection table" and satisfy hp rating and driven speed; (3) under "driven speed" select the nearest rpm required to obtain complete specifications on stock drives and chains. Whitney Chain & Mfg. Co.

PUMPS AND ACCESSORIES

Fire Pumps (HH) Single stage and two-stage fire pumps, methods of drive, and application are comprehensively covered in a multicolor illustrated bulletin. Drawings and dimensional data are set forth on both types of pumps. Selection charts cover capacity, heads, hp range, and rpm of each pump for electric motor, Diesel, gasoline engine, or steam turbine drive. Peerless Pump Division, Food Machinery and Chemical Corporation.

Sump Pump (II) Information is contained in a new bulletin that covers the features of a submersible all bronze construction floatless sump pump. Complete specifications and operating principles of the automatic floatless switch are given. Price list and pump capacity at various heads are included in table form. Kenco, Inc.

Rotary Pumps (JJ) Drawings of six different types of rotary pumps

COMPLETE DATA on Industrial Thermometers

NEVER BEFORE has complete data on liquid-in-glass INDUSTRIAL THERMOMETERS been put into such an easy-to-use reference guide form.

If you purchase or use thermometers, you'll want your copy in a hurry.

Write for Princo Bulletin "E"

PRECISION
THERMOMETER & INSTRUMENT CO.

PRINCO

1483 Brandywine Street, Philadelphia 30, Pa.
In Canada: Peacock Brothers Limited

along with a brief description of each are contained in a new bulletin, just released. The pump is designed to handle residual and distillate fuel oils, crude oils, lubricating oils, hydraulic oils, and similar fluids. Capacities are listed from 0.5 to 1000 gpm at 500 psi and 150 gpm at 1500 psi. DeLaval Steam Turbine Company.

Two-Stage Pump (KK) Specifications and features are presented in a four-page bulletin for a two stage centrifugal pump. A cross-sectional drawing (with each part identified) illustrates how hydraulic balance is maintained. Outline dimensions and rating tables are included for 5 sizes of this model. Warren Steam Pump Company, Inc.

Mechanical Seals (LL) New 12-page illustrated bulletin describes three types of mechanical seals for centrifugal pumps. Cut away drawings of stuffing boxes in centrifugal pumps are shown and descriptive information explains the basic operating principles. Included also are several maintenance hints on the care of seals. Byron Jackson Co., Pump Division.

Worthington Pump and Machinery Corp. (MM) Centrifugal pumping equipment employed in the chemical process industries is described and illustrated in a new bulletin. Complete information on a mechanical seal—specially designed to prevent leakage of corrosive liquids—and this company's corrosion resistant metal is offered. Worthington Pump and Machinery Corporation.

TOOLS AND SPECIALTIES

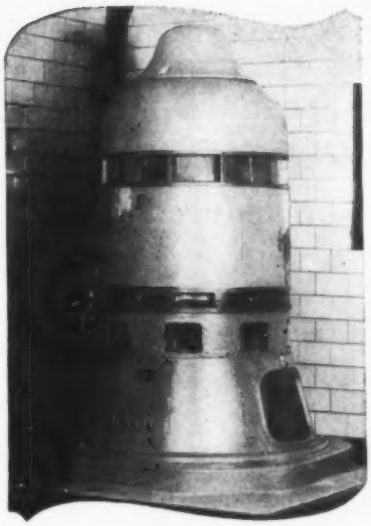
Restoring Fits (NN) Recent issues of the Metco News reports that restoring fits by rebuilding metal parts has proved to be a great money and time saver. Actual case histories are given for several types of applications such as axle shafts, brake drums, cylinder liners, gland sections, plungers, and lathe beds. Metallizing Engineering Co., Inc.

Portable Power Unit (OO) Just released bulletin contains information on the four features listed for this company's portable power unit. Various case histories bring out the fact that the unit can be employed for such operations as pipe threading, pipe cutting, and windlass for pulling cable. Price list for several kits is included. Beaver Pipe Tools, Inc.

Instrument Valve (PP) Just issued a new bulletin provides information on new drop forged steel instrument valves for meter, gage, instrument, and other small lines. Bulletin contains dimensions, weights, prices, and operating data. Accurate testing methods are shown and working pressure ratings are illustrated and described. Edward Valves, Inc.

VALVES, PIPING, AND FITTINGS

Plug Valve (QQ) Eccentric principle of this company's plug valve is illustrated and explained in a new bulletin. The description also includes a list of performance features. Of particular importance is a two page service recommendation table which contains



What's the value of

HIGH PRECISION IN MANUFACTURE

Precision is a very important requirement by the Layne organization. It is the only feature that can adequately support skilful engineering and top quality materials. The results of high precision are,—smoother operation, greater quantities of water and lower upkeep cost.

All well water systems are complicated under ground construction projects that require much more than ordinary skill. Fortunately Layne has an abundance of real "know how" that came from years of world wide experience. When they plan a well water system, furnish the pumps and do the work complete, you get a thoroughly dependable job that provides years and years of fine service.

If your plans call for more water in 1950, why not call in Layne first, and obtain the value of their proved "know how" and the satisfaction of dealing with a firm of highest reputation. For catalogs bulletins etc., address LAYNE & BOWLER, INC., General Offices, Memphis 8, Tenn.

LAYNE

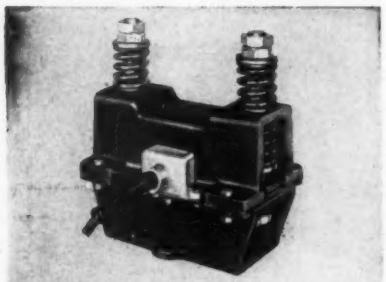
BUILDERS OF HIGH EFFICIENCY

WELL WATER SYSTEMS

ASSOCIATED COMPANIES: Layne-Arkansas Co., Stuttgart, Ark. * Layne-Atlantic Co., Norfolk, Va. * Layne-Central Co., Memphis, Tenn., * Layne-Northern Co., Mishawaka, Ind. * Layne-Louisiana Co., Lake Charles, La. * Louisiana Well Co., Monroe, La. * Layne-New York Co., New York City * Layne-Northwest Co., Milwaukee, Wisc. * Layne-Ohio Co., Columbus, Ohio * Layne-Pacific, Inc., Seattle, Wash. * The Layne-Texas Co., Ltd., Houston, Texas * Layne-Western Co., Kansas City, Mo. * Layne-Minnesota Co., Minneapolis, Minn. * International Water Corporation, Pittsburgh, Pa. * International Water Supply, Ltd., London, Ont., Can. * Layne-Hispano Americana, S. A., Mexico, D. F. General Filter Company, Ames, Iowa

SYNTRON

Speeds Up Bulk Material Handling -- at Reduced Costs!



BIN VIBRATORS
Make Stubborn Materials Flow Freely

VIBRATORY FEEDERS
Up to Hundreds of Tons per Hour — Rheostat Control of Flow

SMALL PARTS FEEDERS
Single Line Feed — Piece by Piece

SELENIUM RECTIFIERS
As Individual Plates or Stacks

Write for literature.

SYNTRON CO.
425 Lexington, Homer City, Pa.

suggested metals for numerous acids and alkalis. DeZurik Shower Co.

Bronze Valves (RR) Design features of a bronze globe or gate valve is offered in a colorful four page bulletin. Diaphragm construction details are shown along with complete over-all dimensions. Valves range in size from ¼ in. to 2 in. and can be operated at pressures up to 150 psi. Hancock Valves.

Disc Valves (SS) General service quick-operating valves for blow-off, general service, fire protection, chemical process, soot blower, and water column blowdown are described and illustrated in a 14 page bulletin. Design and construction features are shown in detail along with complete tables of dimensions, weights, and list prices. Everlasting Valve Company.

Strainers (TT) Revised four page bulletin offers data and information on a line of screw and flange type strainers from ¼ to 3 in. pipe size. Sectional views are shown, and each of the features are thoroughly explained. Complete dimensions, weights, and price lists along with typical suggestions for installing are included. Yarnall-Waring Company.

HEATING, VENTILATING, AND AIR CONDITIONING

Year-'Round Ventilation (UU) Problems involved in supplying clean fresh air both in winter as well as in summer, are discussed in a six page folder. Photographs show several air handling units installed in a variety of plants. Typical adaptations of the units are also shown. Dravo Corporation.

Heat Loss Data (VV) Just published bulletin provides data tables for computing heat loss and figuring heat requirements to determine heat loads and fuel consumption. In addition to tables on outdoor design temperatures, the bulletin contains information on common types of industrial construction, heat losses through windows, door infiltration, heating constants, and a complete description of self-contained direct fired industrial heating units. Thermobloc Division, Prat-Daniel Cor-

Unit Dust Collector (WW) Discussions and illustrations of a packaged air filter has been released in a four page folder. The features of the unit are described in detail along with the advantages of minimum space and maintenance requirements. Three sizes range in capacities from 450 to 1800 cfm. The Kirk and Blum Mfg. Co.

Dust Collectors (XX) Problems of nuisance dust and recovery of usable powdered materials in rubber manufacturing operations are taken up in a new four page bulletin. The solution —hooding and piping arrangements trap the dust at the source and prevent disbursement to working area— is explained in detail. Photographs and drawings explain how these results are obtained. American Wheelabrator and Equipment Corporation.

Blowers and Exhausters (YY) Recently published bulletin contains complete information on two types of electric blowers and exhauster for furnaces, cupolas, gas boosters, or when pressures up to 2 lb must be overcome. Characteristic curve, capacity, selection, and outline dimensions are included. Buffalo Forge Company.

MISCELLANEOUS

Insulation (ZZ) New 16 page book-booklet describes thermal insulations for industrial and building applications. Data on thermal conductivity and sound absorption properties are included. The booklet is colorfully illustrated with numerous application photographs. Owens-Corning Fiberglas Corporation.

Lubrication Protection (AAA) Colorful condensed catalog on lubricating devices describes and pictures a line of constant level, gravity-feed, wick feed, thermal, bottle, under-feed oilers, combination oil cups, and oil gages. Application suggestions on how waste, dangers, and guesswork of hand-oiling can be eliminated are presented. Trico Fuse Mfg. Co.

Publication (BBB) This company has made available two listings of literature which has been previously published on nickel alloy steels, stainless steel, nickel cast irons, nickel brasses and bronzes, and nickel plating. The listing should prove invaluable to engineers, production men and metal users. The International Nickle Company, Inc.

Chain Lubricants (CCC) Valuable information pertaining to oven chain lubrication is offered in a four page bulletin. The component parts are carefully discussed, and helpful ideas are given on installation problems and operating principles. Advantages of the system are thoroughly explained. Bel-Ray Company, Inc.

Couple your power right, Your machines will last much longer!

LOVEJOY L-R FLEXIBLE COUPLINGS

Type "C"
Pat. & Pats. Pend.

What *is* right? Each kind of service requires its particular coupling. Lovejoy's complete catalog, and Quick-Finding Selector Charts give you valuable and ready assistance on the couplings for *your* duties—any service from 1/6 to 2500 h.p. Send for them.

LOVEJOY FLEXIBLE COUPLING CO.
5043 W. Lake St. • Chicago 44, Ill.
Also Lovejoy Variable Speed Transmissions and Lovejoy Universal Joints

READERS' GUIDE

(Continued from page 28)

117—See page 140. Tube Cleaners: A simple water feeding device built into Airetool condenser cleaners keeps drill heads cool, and flushes out scale cuttings. Lightweight construction and quick positive control. Write for full details. Airetool Mfg. Co.

118—See page 114. Pipe Wrench: Housing is unconditionally guaranteed against breakage or distortion. Handy pipe scale on hook jaw. Instant-action non-slip, non-lock jaws. Insist on Rigid at your Supply House. Get more information from The Ridge Tool Co.

119—See page 147. Pipe Tools: Write for complete new Catalog No. 49—free! Shows a complete line of hand tools, ⅛ to 12 inch; electric pipe & bolt machines, power drives, etc. Beaver Pipe Tools, Inc.

120—See page 44. Power Pipe Machines: You can save up to 80% on pipe threading time by using a portable Toledo No. 999 Power Pipe Machine instead of hand methods. Get full details from new catalog which is yours for the asking. The Toledo Pipe Threading Machine Co.

121—See page 163. Tube Cleaners and Expanders: Bulletin 47-A contains complete information on Wilson standard tube cleaners that fit your special needs. Bulletin 380 for data on general tube expanders and Bulletin 420 for information on special tube expanders for heat exchangers. Specify bulletins you want. Thomas C. Wilson, Inc.

122—See page 156. Tube Cleaners: New ROTOJET cleaners, air or water-driven models, for practically any size straight or curved tubes. Use less power. Write for more details and prices. Elliott Company —Roto Division.

TRAPS, STRAINERS AND SEPARATORS

123—See page 118. Steam Traps: Catalog No. 448 furnishes complete data on the Nicholson line of piston and weight-operated steam traps. Write for your free copy. W. H. Nicholson & Co.

124—See page 65. Impulse Steam Trap: Discharge continuously under heavy loads, quickly brining equipment to operating temperature. Keep equipment at peak efficiency by discharging condensate at short intervals, rather than waiting for quantities of it to collect. Small size, easy maintenance, low cost. Write for more details. Yarnall-Waring Co.

125—See page 148. Trap With No Moving Parts: Provides continuous and complete air and condensate elimination, and visual operation indicator; requires no by pass; fits into line like a valve. Write for Drainator Catalog. The Coe Mfg. Co.

126—See page 128. Strainers: Bulletin S-201 describes strainers available in 6 sizes ½" to 2" for pressures up to 600 lb. Prevent rust, scale and dirt from clogging steam equipment. Yarnall-Waring Co.

127—See page 2. Steam Trap Handbook: Tables, charts, diagrams and rules for selecting traps, giving complete explanations, make the new 36-page book a handy reference volume for every engineer's library. Send for Armstrong Steam Trap Book. Armstrong Machine Works.

128—See page 155. Continuous Flow Steam Trap: Extraordinary discharge capacity. Valve opening determined by height of water in float chamber. Self-cleaning valve never leaves seat. Send for Publication 4340—contains complete details. Cochrane Corporation.

129—See page 137. Stickle Series 100 Steam Trap: Wherever steam is used in manufacturing and processing, Stickle equipment saves fuel and increases production efficiency far above the cost of the equipment. Send for Bulletin 115 IP describing these traps and for other bulletins on the complete line of Stickle steam systems and specialties. Stickle Steam Specialties Co.

130—See page 13. Transmission Belts: Condor Compensated Belt gives longer service because of equalized ply stresses—a patented feature. Condor Whipcord V-Belts, Condor Whipcord Endless Belts, and Ray-Man V-Belts for rough, tough drives are also exclusive Manhattan constructions. Write for details and prices. Raybestos-Manhattan, Inc., Manhattan Rubber Div.

131—See page 125. Steam Trap Book: Send for copy of "Solving Steam Trap Problems" for more information on the uses of the three Super-Silvertop bucket traps for pressures up to 200 psi. The V. D. Anderson Company.

VALVES

132—See page 168. Automatic Valves: Request your copy of descriptive technical catalog. Over 1500 types and sizes of valves engineered for your protection through safe, dependable service. Golden-Anderson Valve Specialty Co.

133—See page 8. Piping Layouts: A new book of Jenkins Practical Piping Layouts —No. 26 to 50—is in preparation. Write now to reserve your copy. Jenkins Bros.

134—See page 46. Diaphragm Valves: Outstanding advantages include new seating arrangement, positive shut-off, greater flow capacity and easier operation. Write for Circular AD-1761 for complete details on this Crane valve. Crane Co.

135—See page 117. Diaphragm Control Valves: Complete details and application data gladly furnished on restricted inner valve procedure for diaphragm controlled valves offers a quick, economical way to reduce the effective capacity of a larger nominal valve size. Fisher Governor Company.

136—See pages 22, 23. New ALL-Purpose Steel Valve: NOW READY! New Bulletin 501 gives you dimensions, ratings, full data on the new Edward Fig. 444 Series. Send for your copy right away. No cost. Edward Valves, Inc.

137—See page 68. Precision Made Valves: Asure perfect-fitting, interchangeable parts —longer valve life—easier, lower-cost maintenance. Circular 564 will be mailed upon request. Ask for your copy now. The Lunkenheimer Co.

138—See page 144. Butterfly Valves: Write for bulletins describing Rockwell valves for air, gas, liquids and solids. Any desired metal. Pipe sizes to 72". Pressures to 125 psi. W. S. Rockwell Company.

139—See page 3. Automatic Valves: Non-return stop and check valves, pressure reducing valves and back pressure valves available in sizes to keep your manifold heating service out of trouble. Other Foster valves for every type of service. Write for more details and help with your engineering problems. Foster Engineering Company.

140—See page 54. Check Valves: Chapman Tilting Disc Check Valves work with the stream so pipe line stresses are practically eliminated. Head losses are reduced 65% to 80%. Write today for engineering data and reports of tests. The Chapman Valve Mfg. Co.

WELDING EQUIPMENT

141—See page 42. Purox Blowpipe: Write for free folder for more information on the No. 35 Purox Blowpipe that's designed especially for continuous heavy work. The Linde Air Products Co.

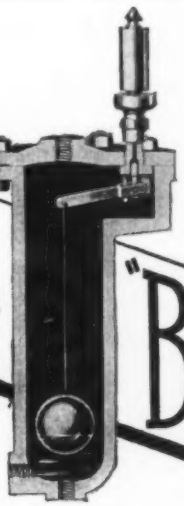
MISCELLANEOUS

142—See page 171. Combustion Engineering Course: Send for book "Opportunities for the Combustion Expert," which offers a complete outline of the Hays Home Study Course. Hays School of Combustion.

143—See page 171. Power Plant Engineers' Guide: A complete steam engineers' library in one book—1500 pages, 65 chapters, and 1700 illustrations. Mail coupon on page 171 for a 7 day free trial offer. Audel Publishing Co.

144—See page 171. Electrical Engineering and Construction: Complete technical service — staff of 10 electrical engineers and designers available for consultation. Capacity to handle complete installations on all industrial and commercial light and power problems. Write today. No obligation. Hyre Electric Co.

145—See page 133. Streamline Your Machine Loading: The Sched-U-Graph removes guesswork, cuts out idle machines and idle men. Any job performed by man or machine can be scheduled and loaded on Sched-U-Graph. Get the whole story. Write for your free copy of "Machine-Load Control, KD 320 b" today. Remington Rand, Inc.



SPECIFICATIONS

Steam pressures.....5 to 150 psi

Bottom to top of cover....12"

Bottom to top of Whistle..16"

Weight.....17 lbs.

Size of connections.....1/2"

To Help you Maintain the SAFETY ZONE LEVEL in Small Boilers and Tanks

"BROWNIE"

LOW WATER SIGNAL

Distributors and Agents in all Principal Cities

Order from your supply house or write for Bulletin 570-B.

Reliability is our first concern in making "Brownie" Low Water Signals. We recognize also the importance of a reasonable price. These two features of the "Brownie" are the result of a construction that provides reliability and convenience for users and economy in manufacture.

Quick-acting float-operated whistle warns of low water level in advance of a dangerous condition. Simple to install. Designed for long trouble-free service.

WRIGHT — AUSTIN COMPANY

3233 Wight St., Detroit 7, Michigan

1111

WA Standard with STEAM USERS SINCE '94

WRIGHT-AUSTIN

SERVING INDUSTRY FOR MORE THAN 50 YEARS

It's the *Powder-Packed*
CUSTOM-BUILT ELEMENT IN
TRICO FUSES
THAT MAKES THE BIG
Difference

No other renewable fuse can offer as many safety and performance features because only TRICO Renewable Fuses are "Powder-Packed".

TRICO "POWDER-PACKING" GIVES YOU THESE ADVANTAGES:

- Stop Needless Fuse Blowings.
- Increased Production.
- Reduced Fuse Costs.
- Stop Vicious Fuse Tampering.
- Create Current Savings.
- Reduce Fire & Accident Hazards.
- You Get THREE TIMES The Service From Your Fuse Investment.

WRITE FOR FREE BOOKLET 206-A

"They Lock Like A Vise" . . . TRICO
"KLIPLOK" TEST CLAMPS

Just the thing for heavy duty temporary connections, for meter and motor testing, jumpers, battery charging, cable and bus bar taps, welding, etc. Clamps flat or round objects.

WRITE FOR BULLETIN NO. 7

TRICO FUSE MFG. CO. Milwaukee, Wis.

Now every shop can have the advantages of BAND SAWING

The new Wells Model 49A fits the smallest shop's budget, yet it does a man-sized job in any plant. From its welded steel frame to its tubular steel base, the Wells Model 49A is a rugged shop tool that will give long, dependable service. Its portability is unequalled. Capacity: Rectangular—3½" x 6⅜", Rounds—3½" diameter. Easy to operate without special training, the Model 49A can be used by anyone in the shop. Automatic shut-off at the end of the cut eliminates the need for the operator to stand by. Write for complete details.

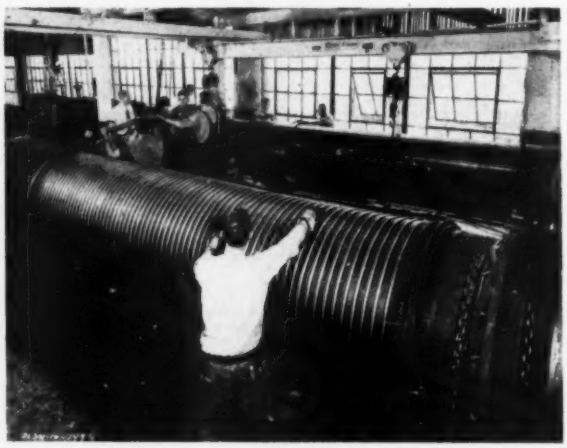
Wells SAWS
Wells
Products by Wells are Practical
METAL CUTTING BAND SAWS
WELLS MANUFACTURING CORPORATION
2300 GROVER AVE. • THREE RIVERS, MICH.

"SPOT" NEWS OF INDUSTRY

(Continued from page 120)

started as a result of a six-year testing program on this type of hose conducted by the Corps of Engineers, U. S. Army. A test section of hose, installed by army engineers on the dredge Burgess, withstood the scouring effect of 60,000,000 yards of sand and river mud over a six-year period before requiring replacement.

Consisting of 15 piles of rubberized fabric and a coil of seven-eighths inch copperized steel wire for reinforcement over a one-inch tube of high-grade natural rubber, the finished hose units each weigh 8,080 lb. Breakdown of this



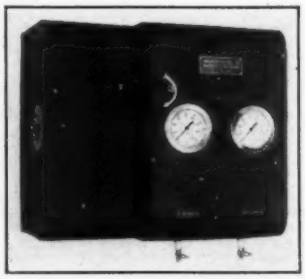
Spending too much TIME and MONEY operating your Zeolite Water Softeners or Sand Filters?

Getting erratic operation?

Then consider making them **AUTOMATIC** using the electrically operated **H & T POPPET** type multiport valves. They are "TOPS" for performance and **low in cost,** too.

Savings in labor, salt and improved operation may pay for the valves in as little as one year.

Write for details.



HUNGERFORD & TERRY, INC.
Clayton, New Jersey
Over 50 years experience—Over 5,000 installations

weight is 690 lb of cotton, 2813 lb of compounded rubber, 2,287 lb of copperized steel wire, 2,200 lb of steel in hose nipples and 90 lb of steel clamps. Outside diameter of hose at the nipples is 47 in.

This type hose is cured at temperatures varying from 250 to 275° F for 270 min. Twelve hours are required for the cured hose to cool sufficiently to handle.

Pennsylvania Launches Study on Polluted Air

Announcement has been made that a mobile air pollution laboratory will be equipped to sample and analyze atmosphere suspected of containing harmful or annoying gases and dust. The program will be undertaken by the State of Pennsylvania's Bureau of Industrial Hygiene under the direction of Dr. Joseph Shilen, bureau director. The laboratory, the only one of its kind in the United States, will be ready within the next 60 days—and it will be equipped with all the necessary scientific instruments and devices to run on-the-spot analytical studies. However, further testing will be conducted at the bureau's permanent laboratories. Air pollution surveys will be made at the request of industrial plant managements, civic groups, and municipal or county officials. Built with its own power-generating plant and heating system the mobile laboratory can make surveys and studies away from a power supply source. In some instances analysis must be made immediately after the air sample has been obtained as chemical changes might occur.

One instrument in the field laboratory will be an electrostatic dust and fume sampler. This device will obtain precise quantitative samples of dusts, fumes, and smoke. Airborne particles are deposited on the inner surface of a collecting cylinder of the device. The collected samples are

ALBERT
"RINGS THE BELL"

VALVES AND FITTINGS
Tube Turns—Dresser—Victaulic
Cast Iron or Steel
Forged Steel
Special Alloys
Water Main

PIPE
Wrought Iron
Steel
Structural
Cast Iron
Copper-Steel
Seamless
Electric Weld
Spiral, Lap & Butt Weld
Shore-Dredge
Speed-Lay

SPECIALISTS IN PREFABRICATED PIPING
Complete facilities for Bending, Coiling, Beveling, Swedging, Flanging, Grooving, Welding, Cutting to Sketch, and Threading to meet your most rigid requirements. Bitumastic or Cement Lining—Testing—All meeting Standard Specifications.

IMMEDIATE DELIVERY

SPEED-LAY PIPE SYSTEM
The complete packaged PIPE SYSTEM for fast-laying, temporary and semi-permanent lines for water, compressed air and other services.
WRITE FOR FREE BOOKLET

PILING—Sheet Piling—Lightweight • Tubular—All sizes
PIPE PILES—Lapweld • Seamless • Electric Weld • Spiral Weld
PILE SHELLS—Spiral Welded • Hel-Cor Riveted
CAISSONS
PILE FITTINGS—All types and sizes for steel and wood • Cobi Pile Tips • Cast Steel and Iron Points • Plates and Shoes • Cast Steel and Malleable Iron Sleeves
CULVERTS—Corrugated • Spiral or Riveted Steel

ALBERT
PIPE SUPPLY CO., INC.
Berry at North 13th Sts., Brooklyn 11, N. Y.
Phone EVergreen 7-8100

MONEY SAVING VALUES IN . . . . .
ELECTRICAL POWER EQUIPMENT

HERE'S A PARTIAL LISTING OF OUR LARGE STOCK OF
REBUILT
SQUIRREL CAGE MOTORS
3 Phase, 60 Cycle—220 or 440 Volt
(*2200 Volt or Higher)

HP	Make	Type	Speed
750	*G. E.	KT	720
700	*G. E.	KF-56947	1800
600	*Westg.	CS-6-34-15	1200
500	*G. E.	K-559DZ	3600
500	G. E.	KTP-567	1200
500	G. E.	IK	900
400	*Westg.	CS-936	1800
400	Al. Ch.	ANW	900
400	*Westg. Vert.	CS	720
350	G. E.	IK-14	514
300	G. E.	FT-559A	1800
300	G. E.	K-559BZ	1200
250	G. E.	KT-559	1800
250	*G. E.	IK	900
250	G. E.	KT-564	900
250	Westg.	CS	900
200	*Al. Ch. BB	AR	1800
200	Wagner	26V	1800
200	Reliance	AA-C60855	1200
200	*Westg.	CS-956A	900
200	G. E.	IK-15A	450
150	Westg.	CS-771-1C	1750
150	Cont. TEFC	NP-743K	900
150	Westg.	CS-950A	600
125	Westg. BB	CS	3600
100	*G. E.	KT	1800
100	Burke	KM-12.5	1200
100	Al. Ch. BB	ARZ-826	900
75	*Al. Ch.	AR-223-BS	1800
75	Al. Ch. BB	AR-505	1200
75	Al. Ch.	AR	1200

CHICAGO ELECTRIC
Carries a complete stock of rebuilt equipment of the following types:
- SQUIRREL CAGE MOTORS
- SLIPRING MOTORS
- SYNCHRONOUS MOTORS
- DC MOTORS
- M. G. SETS
- AC and DC GENERATORS
- TRANSFORMERS
- SWITCHBOARDS
- CONTROLS
- HOISTS
- CRANES
- COMPRESSORS
- PUMPS

CHICAGO Electric Co.
1333 W. CERMAK RD. • CHICAGO 8, ILL.

IT HAS WHAT YOU NEED IN A THERMOSTAT
It maintains a home in ideal comfort at any desired temperature.
It operates on a variation of ½° above or below the point set.
It is a corrosion-proof mercury switch contact equipped control.
It performs perfectly for years without any servicing attention.
It is a masterpiece in mechanical precision, design and appearance.
Complete catalog sent upon request

MERCOID APPROVED CONTROLS
FOR HEATING, AIR CONDITIONING, AND INDUSTRIAL APPLICATIONS
THE MERCOID CORPORATION • 4201 BELMONT • CHICAGO 41, ILL.

PIPE MARKERS

anyone can use— everyone can read

QUIK-LABEL Pipe Markers conform to American Standards Association Pipe Identification System. QUIK-LABELS come on handy cards . . . stick without moistening. Names of materials printed in large black letters on correct ASA background colors. CAN BE READ UP TO 75 FEET. Markers for over 140 materials, ***including all materials listed in ASA Standard A13,*** available on Brady Stock Cards. Specials made to your order. QUIK-LABEL Pipe Markers are Silicone Plastic coated to resist dirt, grease, fumes, moisture . . . indoors or out. Replace slow and costly painting and hand stenciling. Exclusive Starter-Strip automatically releases part of label for fast peeling. QUIK-LABELS mark your pipes so that anyone who can read will know what's in them. ***QUIK-LABELS leave no room for doubt . . . or tragedy.*** Write for useful literature and FREE SAMPLES today.

FREE SAMPLES

W. H. BRADY COMPANY | Established 1914

Manufacturers of Self-Sticking Tape Products

270 W. Wells St., Milwaukee 3, Wis. • *Distributors in 125 Cities*

HERE'S THE NEW QUICK WAY TO FIX BROKEN CONCRETE FLOORS

TAMP SMOOTH! TRUCK OVER!

Use durable INSTANT-USE . . . a tough, plastic material which you simply shovel into hole—tamp—and run traffic over immediately. NO WAITING. Bonds tight to old concrete. Makes smooth, solid, heavy-duty patch. Withstands extreme loads. Keep a drum on hand for emergencies. Immediate shipment.

MAIL COUPON **for FREE TRIAL OFFER**

INSTANT-USE

FLEXROCK COMPANY
3605 Filbert St., Philadelphia 4, Pa.
Offices in Principal Cities

Please send me complete INSTANT-USE information and details of TRIAL ORDER PLAN—no obligation.

Name .....
Company .....
Address .....

then available for analysis by weight, count, chemical, or radiological study.

Another instrument can determine concentrations of hydrogen sulphide which is one of the most toxic of industrial gases. Special gas detectors are included for sulphur dioxide, carbon monoxide, nitrogen dioxide, and benzol, along with devices for checking the explosibility and flammability of gases and vapors. In addition an osmoscope will be employed to detect and identify odors. Because weather conditions are important factors in air pollution, a complete set of meteorological instruments will be installed.

As the program progresses instruments will be added to the field laboratory, one of these will be a Geiger counter to measure radio-activity. Plans are already under way for additional mobile field laboratories.

Coal-Burning Gas Turbine Tests Prove Successful

Tests viewed at the American Locomotive Co's. plant at Dunkirk, N. Y. by presidents of leading coal-carrying railroads and coal producing companies, showed that a locomotive-size gas turbine could be fed continuously with pulverized coal. According to R. B. White, chairman of the Locomotive Development Committee of Bituminous Coal Research, Inc., the tests also indicated that coal can be burned efficiently under a pressure of 60 psi.

"While it would be premature to assume that all technical problems are solved", Mr. White said, "the tests today have shown bituminous coal can operate a gas turbine. We are particularly pleased with the combustion efficiency, in excess of 90%, and also with the ash removal equipment performance. Inspection of the experimental turbine following a 38 hour run showed that all components of the coal-burning gas turbine power plant were in excellent condition".

Fig. 732
Pat'd Pats. Pend.
Drawer is extra

FOR VARIED PURPOSES

HALLOWELL

WORK BENCHES OF STEEL

Made in an assortment of standardized heights, widths and lengths, these "HALLOWELL" units can be used either individually or bolted together to form a continuous work bench of any desired length—thus flexibility is a money-saving feature ***not practicable*** with "nailed-together" wooden benches. Serviceable, ***ready-made*** "HALLOWELL" Work Benches of Steel have a pleasing, clean-cut appearance, too, and are ideal equipment for modernizing your shop. "HALLOWELL" Benches have smooth, long-wearing steel tops, are also available with heavy, high-grade laminated wood tops . . . or steel tops covered with "Tempered Presdwood." The "HALLOWELL"—rigid as a rock—does not require costly bolting to the floor.

Other "HALLOWELL" Products include: "HALLOWELL" Foreman's Desks of Steel; "HALLOWELL" Tool Stands of Steel, with or without casters; "HALLOWELL" Steel Platform Trucks; "HALLOWELL" Stools and Chairs of Steel.

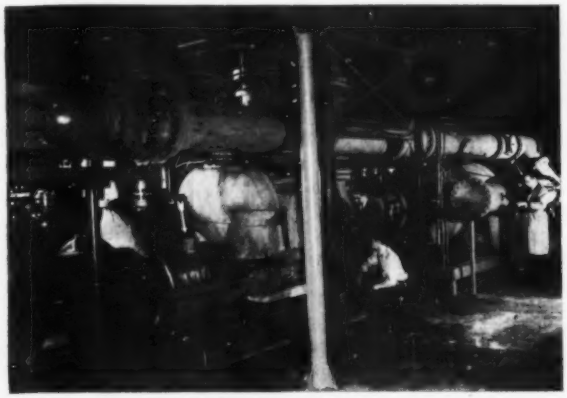
SPS STANDARD PRESSED STEEL CO.

BOX 548 JENKINTOWN, PENNSYLVANIA

"HALLOWELL Counts with the Men Who Count"

Three major components to make up the coal-burning gas turbine—the compressor, the combustor, and the turbine. Gas, which drives the turbine, is super-heated air. The gas turbine is simple, compact, requires minimum lubrication and attention and operates without smoke. The need for water is eliminated.

Laboratory work leading up to today's tests has been carried on under the supervision of J. I. Yellott, director of research for the Locomotive Development Committee, and



by a number of organizations which include Battelle Memorial Institute at Columbus, Johns Hopkins University at Baltimore, the Institute of Gas Technology in Chicago, and the Turbodyne Corporation at Hawthorne, California.

Turbine under test at Dunkirk was made available to the committee by the U. S. Bureau of Mines. The Allis-Chalmers Manufacturing Company, builders of this experimental turbine, has just completed another gas turbine which will power the first coal-burning gas turbine locomo-

FLEXCO

BELT FASTENERS AND RIP PLATES

FOR HEAVY CONVEYOR AND ELEVATOR BELTS OF ANY WIDTH

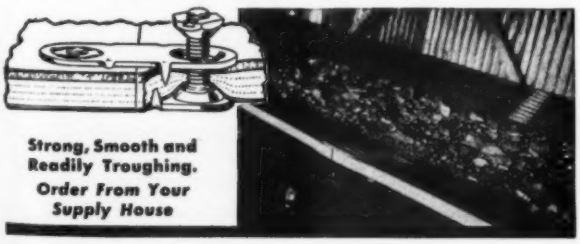
FLEXCO Fasteners make a tight, butt joint of great strength and durability . . . distribute the strain uniformly. Operate smoothly over flat, crowned or take-up pulleys. Made of steel, Monel, Everdur and Promal.

FLEXCO Rip Plates are for repairing and patching damaged belts.

Ask for Bulletin F-100

FLEXIBLE STEEL LACING COMPANY

4601 Lexington St., Chicago 44, Illinois



Strong, Smooth and Readily Troughing.

Order From Your Supply House

DON'T BE A LATE STARTER

1950 promises to be a tough, competitive year. One way you can get a fast start on profitable operation is to use standard Wilson-Dudgeon Tube Expanders to help solve your production or maintenance problems on tubular apparatus. Backed by 97 years of solid experience, Wilson-Dudgeon Tube Expanders will assure you of fast, easy, reliable tube rolling to cut down-time and increase production-time. Here are two of the profit-making Wilson-Dudgeon Tube Expanders:

Wilson-Dudgeon Model 38 Tube Expander for tubes 1" O.D., up. Self-feeding, parallel rolling and flaring action seats tubes quickly and solidly.

Wilson-Dudgeon Model 41 Tube Expander, parallel rolling, self-feeding with ball bearing thrust collar for rolling heat exchanger tubes ½" O.D. to 2½" O.D., into tube sheets to 6".

No matter what your tube expander problem, you can be sure of getting a Wilson-Dudgeon Tube Expander that will fit your specific application. Write us, giving full details or send for Bulletin 380.

CUT FUEL COSTS *with* WILSON TUBE CLEANERS

Remember—1/16" of scale often wastes 10%, or more, in fuel. A Wilson Tube Cleaner makes short work of the toughest deposits . . . cleans both ferrous and non-ferrous straight or curved tubes. Air, steam, water or electrically driven cleaners available for tubes 3/8" I.D., to the largest ever cleaned. Write for Bulletin 47-A.

THOMAS C. WILSON, INC., 21-11 44th AVENUE, LONG ISLAND CITY 1, N. Y.

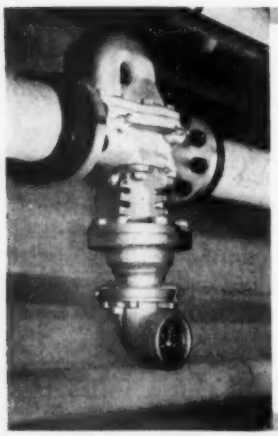
TW-772

WILSON TUBE CLEANERS

ANOTHER IMPORTANT FEATURE OF SHUNTFLO STEAM METER

BUILT STRONGER TO LAST LONGER

Metering steam, air, or gas accurately . . . year after year . . . calls for the rugged construction of BUILDERS SHUNTFLO METER. All parts subject to pressure are high-tensile MEEHANITE iron, bronze, or cast steel. Wall thicknesses are ample weight for the pressures and temperatures of the service. Users know they can rely on the Shuntflo Meter to provide full information (accurate within ± 2%) in pounds of steam or cubic feet of air or gas — and at negligible cost for service or maintenance. Strength of construction is another of the many good reasons why so many industrial plants, district heating companies, commercial buildings, and public utilities have standardized on the Shuntflo Meter. Easy to install in pipelines from 1" to 14" diam. For engineering recommendations and new Bulletins 400-F1 and 400-F2, address Builders-Providence, Inc. (Division of Builders Iron Foundry), Providence 1, R. I.



BUILDERS PRODUCTS

Flow Meters and Controllers . . . Mechanical and Differential . . . for Liquids, Steam, Air, and Dry Materials.

. . .

The Venturi Meter

. . .

Chlorinizers — Chlorine Gas Feeders.

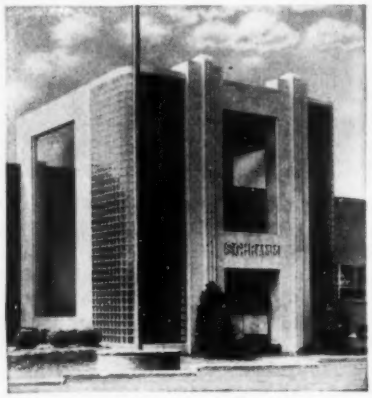
BUILDERS PROVIDENCE *Instruments*

tive. A second power unit, on order with the Elliott Company of Jeannette, Penna., is expected to be completed next spring.

Sponsors of the Locomotive Development Committee are the Baltimore and Ohio Railroad, The Chesapeake and Ohio Railway, the Illinois Central Railroad, the Louisville and Nashville Railroad, the New York Central Railroad, the Norfolk and Western Railway, the Pennsylvania Railroad Company, The Virginia Railway, and the Wheeling and Lake Erie Railroad. Coal supporters are Island Creek Coal Co., M. A. Hanna Co., Pittsburgh-Consolidation Coal Co., Pocahontas Fuel Company, and Sinclair Coal Company.

Schramm Inc. Celebrates Golden Anniversary

One of the nation's leading manufacturers of air compressors, Schramm, Inc. of West Chester, Pa., is celebrating their fiftieth anniversary this year. Starting with a modest little machine shop in Philadelphia, Pa., on January 2, 1900, Schramm compressors are now built in a large, modern factory covering an area of 17 acres.



C. D. Schramm, the founder originally dedicated his business to servicing and selling gas engines. In 1901, Henry N. Schramm, now president, joined his father at a

BREAKDOWNS FIRES POWER LOSSES COST YOU MONEY

Eliminate costly repairs, fire hazards and work stoppages with **TORNADO*** High-Velocity Blowers.

Shoot a concentrated blast of clean, dry air into motor and equipment interiors to blow out all dirt, grit and greasy lint. Absolutely safe for intricate mechanisms.

Equipped with suction attachments, **TORNADO*** High-Velocity Blowers become versatile pack-carried vacuum cleaners.

BULLETIN 579 CONTAINS COMPLETE INFORMATION

*Trade Mark Reg. U. S. Pat. Off.

BREUER ELECTRIC MFG. CO.
5132 RAVENSWOOD AVENUE • CHICAGO 40, ILLINOIS

time when electric ignition was being developed for gas engines. Together they developed a make-and-break spark ignition head that quickly established them as gas engine experts along the Atlantic seaboard.

The next important development was the first complete portable engine driven compressor in 1908, featuring an interchangeability of parts that has become one of the outstanding features in the development of all the company's compressors.

The business soon grew to proportions that made larger manufacturing facilities necessary and in 1917, the business became established in West Chester, Pennsylvania. Many new ideas and improvements in compressor design followed in rapid succession including: multi-cylinder, engine driven multi-cylinder compressors, Diesel engine driven portables, clutch between engine and compressors, electric starting on all engine driven models, mechanical intake valve that out-moded the two-stage type of compression, streamlining of compressors, increased speed to conform with modern engine speeds and many other innovations.

"Dry-Ice" From Boilers

By-product steam and by-product power, depending upon whether power or steam is the primary objective of generation, are common in the terminology of process industries. However, to find steam a by-product of the process itself is unusual. Such is the case in the manufacture of "dry-ice" from CO_2 in the flue gases at the Chicago plant of Pure Carbonic, Incorporated.

With this process, the CO_2 in the flue gases is carried as high as possible to permit maximum extraction, even with some sacrifice in boiler efficiency, and steam becomes a by-product used to drive auxiliary equipment and for plant

Change Down-Time Caused By Leaky Pipe Connections Into Productive Hours With KEY Graphite Paste

- Costly steam leaks and down-time for repairs are eliminated when pipe joints are sealed with KEY Graphite Paste—the sealing compound especially developed for high pressure steam and oil proof service.
- KEY Graphite Paste is economical to use...requires only water for thinning. It expands when heated and packs up under pressure to provide an absolutely permanent seal... yet joints can be easily disconnected without damage to thread or gaskets. Listed by Underwriters' Laboratories.

FREE SAMPLE — *Send for liberal free sample of KEY Graphite Paste. Give it an actual working test in your plant.*

KEY COMPANY
321 S. 27th St., E. St. Louis, Ill.

KEY Company

READ HOW

Houghto-Solv transformed 15" of heavy sludge (in a 2,200,000 gallon tank) to burnable fuel

This company burned 28,000 gallons of fuel oil per day. Their 2,200,000 gallon storage tank was found to contain a heavy, practically solid accumulation of tarry sludge which reduced the tank's capacity by 48,000 gallons.

After emptying the tank nearly to the sludge level 3 drums of Houghto-Solv were added. Six more drums were added as additional oil was pumped into the huge tank.

Within a short time 15" of sludge had been dissolved and made burnable. Nozzles and strainers were clean and fuel storage space was increased. Houghto-Solv had solved another tough sludge problem! Why not check its possibilities for economy in your plant? For full information write or call E. F. HOUGHTON & CO., 303 West Lehigh Ave., Philadelphia 33, Pa.

E. F. HOUGHTON & CO.
303 W. Lehigh Ave., Philadelphia 33, Pa.
Please send me the new Houghto-Solv folder and prices.

Name.....
Company.....
Address.....
City.....*State*.....

heating. The boiler installation, put in last spring, consists of one 30,000 lb per hr and two 15,000 lb per hr Combustion Engineering steam generators burning coke breeze on Coxe traveling grate stokers. Oil is utilized as a standby fuel.

Recently tests were conducted to determine equipment capacity with a view to increasing the daily output. Accordingly, the test was carried on for a period of two weeks with the largest boiler operating at a load 20% in excess of its maximum continuous rating, during which time the CO_2 ranged from 17 to 18% with a corresponding efficiency of 65%. When consideration is given to the fact that this efficiency concerns the by-product steam output alone and that the primary product is maximum carbon dioxide, with extraction up to 90% the exceptional performance of the steam generating unit may be more readily understood.

Visual inspection of the boiler, when taken off the line at the conclusion of the test, indicated less slagging than is experienced under usual operation and no adverse effects upon the refractory parts of the setting.

New Addition Augments Alcoa's Hydro Development

Newly completed expansion program consisting of extending the existing powerhouse and adding a fifth hydro-unit with its individual intake, penstock, switchyard, and transformer equipment for the Cheoah Hydro-Electric Development (owned by the Carolina Aluminum Company, a subsidiary of Aluminum Company of America, and operated by the TVA) has just been announced. The unit—housed in a reinforced concrete powerhouse extension matches the appearance of the original powerhouse, located on the Little Tennessee River at Tapoco, North Carolina—makes a substantial and much needed contribution to the peak load

AVAILABLE REPRINTS

Copies of the complete editorial section of the September, 1949 issue, describing the plant engineering activities of the General Motors Corporation are available in a separately bound brochure. Price including mailing is 50 cents.

We also have a few of copies of the following article reprints that are available free of charge to interested parties:

"Chain Belt's Newest Boiler is First 'Step' in 3-Step Plan", W. J. Thuerman, October, 1949.
"Commercial Solvents Installs Boilers Out-of-doors", E. E. Kantz, April, 1949.
"Crankcase Explosions are Rare—But . . ." October, 1949.
"Electro-Motive's Steam Plant is Tops in Modernity", V. L. Wesby, September, 1949.
"GM 'Utilities' Receive Major Attention". H. R. Smith, September, 1949.
"Insulation on 2000 psi Boiler Proves Effective", R. H. Boothby, October, 1949.
"Keep It Clean, says Oldsmobile", R. H. Barlow and W. E. Rasmussan, May, 1949.
"Modernization at Toledo Laundry Cuts Steam Costs in Half", H. A. Quinn and S. T. French, October, 1949.
"Petoskey Diesel Plant Designed With An 'Eye-To-The-Future' ", May, 1949.
"Qualifications of an Effective Industrial Supervisor", A. A. Potter, June, 1949.
"Select Correct Batteries for Starting Diesels", K. A. Vaughan, November, 1949.
"Simplify Determinations of Pipeline Pressure Losses", J. O. Mullen and H. D. Fisher, November, 1949.
"Solvents vs. Sludge", Frank Ross, January, 1949.
"Supervisors Must Develop Favorable Group Attitudes", Edmund Mottershead, November, 1949.
"The Story of Thermal Electric", A. G. Purdue, March, 1949.
"Unit Heaters Require Proper Steam Traps", P. J. Ulrich, March, 1949.
"Water Treatment for Air Conditioning Systems", Wm. A. Tanzola, May, June and July, 1949.

"K" FITTINGS
for
DISCRIMINATING BUYERS

When fittings are *selected,* rather than merely *accepted,* the choice is likely to be "K" Fittings. This is evidenced by the fact that the principal usage of "K" Fittings is in industries where the requirements are severe and exacting—the chemical, food, refining, synthetic, paper, textile, ceramic, and fire-protection industries.

"K" Fittings are close-grained, tough, smooth, symmetrical. Threads of tapped fittings are chased full and clean; openings chamfered so pipe will enter easily. Faces of flanged fittings are accurately milled; bolt holes exactly spaced. All "K" Fittings are approved by Underwriters' Laboratories.

New catalog containing complete data will be gladly sent you upon official request.

PRECISION FITTINGS

THE
KUHNS BROTHERS CO.
1806 McCALL AVENUE
DAYTON 1, OHIO

3,000 SHAPES AND SIZES

generating capacity of the area's power system.

Daily flow of water at the Cheoah development has been regulated entirely by the release of water from Fontana and Santeetlah reservoirs. The fifth unit was added in order to fit the Cheoah development properly into this system of

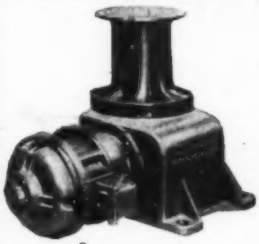
water and power regulation. The new turbine is a vertical shaft type, rated at 40,000 hp at the point of best efficiency. The scroll case is shop formed, field welded steel plate. Construction of the turbine indicates a marked trend toward steel fabrication instead of castings for this type of machine.

The generator is rated at 37,500 kva, 80% pf, 6900 volt, 3 phase, 60 cycle, 164 rpm. The rotor has a WR^2 of 14,500,000 and is mounted on a spherical thrust bearing. Generator and turbine are connected by a one-piece shaft. Because of the size and weight, the generator stator was

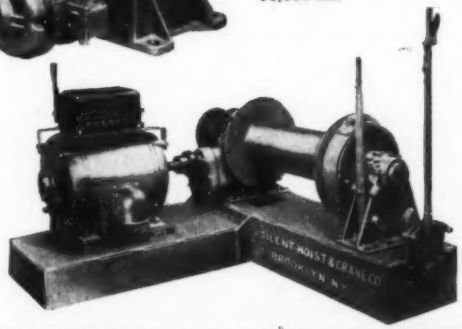
CAR PULLERS, BARGE MOVERS

ELECTRIC, GASOLINE, DIESEL

Let ***Silent Hoist*** Car Pullers, electric, gasoline, and diesel driven Winches serve you. Power-driven Capstans, Gypsies, and single and double Winches for all materials-handling applications — rigging, skip hoists, maintenance, construction, cable ways, etc.



CAPSTAN 6 Sizes: Draw Bar Pull	DRUM WINCH 4 Sizes: Capacities
2,000 lbs.	6,000 lbs.
6,000 lbs.	12,000 lbs.
12,000 lbs.	24,000 lbs.
18,000 lbs.	40,000 lbs.
22,000 lbs.	
30,000 lbs.	



Mfrs. of ***KRANE KAR*** *Swing-Boom Mobile Cranes,* ***LIFT-O-KRANE*** *Fork Lift Trucks, Cranes for Motor Trucks, Capstans, Gypsies, Single and Double Drum Winches, Coal Slicer Hoists.*

SILENT HOIST & CRANE CO.

856 63rd STREET, BROOKLYN 20, N. Y.

★ REDUCE COSTS

★ Improve Production

with precision control insured by—

POWERS

TEMPERATURE INDICATING and RECORDING REGULATORS

End losses caused by OVER-heating of processes or operations requiring precise control. Install POWERS pnuematic regulators. Their accurate control helps to improve quality of products—speed up production and save steam wasted by overheating.

RECORDING REGULATOR

Variety of Models: One and two pen Recording Thermometers; Recording Regulators; Indicating Regulators; Wet and Dry Bulb Recording Regulators; Time Cycle Recording Regulators; Master and Sub-Master Indicating and Recording Regulators, etc. *Write for Bulletin 370.*

INDICATING REGULATOR

For Better Temperature and Humidity Control and valuable aid in selecting the right instruments for your requirements—phone or write our nearest office. There's no obligation. THE POWERS REGULATOR CO., 2777 Greenview Ave., CHICAGO 14, Ill. • 231 E. 46th St., NEW YORK 18, N. Y. • 1808 W. Eighth Street, LOS ANGELES 5, Cal. • Offices in 50 Cities. (101)

THE POWERS REGULATOR CO.

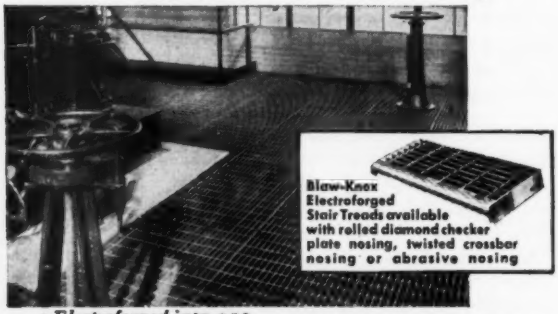
To select the proper drive for any type of service

GET your copies of the latest Cleveland catalogs for full information on all types and sizes of worm gear speed reducers —including rating tables, dimensional diagrams and data for both standard and fan-cooled units. Ask for Catalog 200 for standard drives and Catalog 300 for Speed-aire (fan-cooled). The Cleveland Worm & Gear Co., 3253 E. 80th St., Cleveland 4, O.

CLEVELAND
Worm Gear
Speed Reducers

For personalized service: Write or phone John E. Milliken Cleveland exch. VUlcan 3-4560

the *IDEAL OPEN FLOOR* for every industry


Blaw-Knox Electroforged Stair Treads available with rolled diamond checker plate nosing, twisted crossbar nosing or abrasive nosing

• *Electroforged* into one exceptionally strong piece • *non-slip twisted bar* for safe footing • maximum open area • self-cleaning, with no corners to clog • easily installed • easily maintained • *adaptable* to many uses, indoors and out, for every industry.

BLAW-KNOX Electroforged STEEL GRATING

Open Flooring • Sidewalk Doors • Bridge Surfacing • Catwalks • Sidewalks • Subway Grating • Treads
Many other uses

Send for BULLETIN 2296 TODAY!

BLAW-KNOX DIVISION of Blaw-Knox Company
2072 Farmers Bank Bldg., Pittsburgh 22, Pa.
Offices in Principal Cities

BLAW-KNOX ELECTROFORGED STEEL GRATING

stacked and wound in place, and the rotor was assembled at the job site. The turbine and generator were built by Allis-Chalmers Mfg. Co.

Water is fed through a 17 ft dia by 490 ft long penstock constructed of butt welded steel plates. The shell is designed for 12,500 psi ring tension, 1/16 in. corrosion allowance, 100% joint efficiency, and a minimum thickness of ½ in. A maximum thickness of ⅞ in. was required after allowance for water hammer had been added to static pressure. Since the penstock sections were too large in diameter for transportation, formed plate was shipped to the job and field welded. The new penstock and intake are entirely independent of the older installation and may be operated during periods when necessary or desirable to unwater the older installation.

Three single phase, 12,500 kva, oil insulated, self-cooled transformers, are provided independent of the original switchyard. Low voltage from the generator bus is 6,900 while high voltage is 165,000 with two voltage taps above and two below normal.

The construction work was done by Harrison Construction Company of Pittsburgh, Pennsylvania and Maryville, Tennessee. Design and construction of the project was under the direction of J. P. Growdon, Chief Hydraulic Engineer, Aluminum Company of America.

Modern Coal Mining Operations at Key Coal Mine in Illinois

Latest types of equipment and modern methods are enabling the Key coal mine, near Astoria, Illinois, to produce uniform northern Illinois coal for use on all types of coal burning units. Heat driers dry the coal in a two-stage drying action consisting of mechanical dewatering along with thermal evaporation. Other processing includes re-

GOLDEN-ANDERSON

design and build

over 1500

types and sizes in

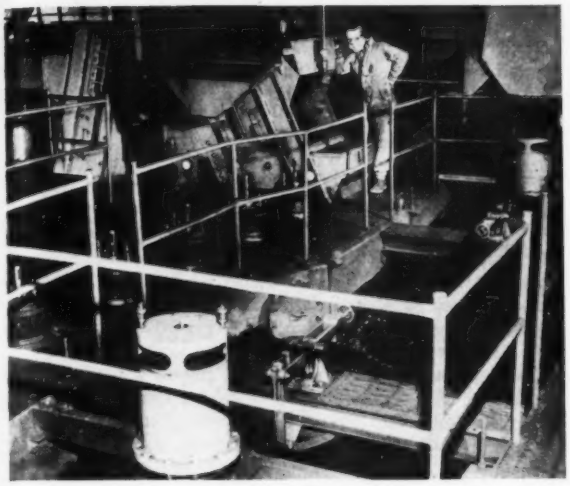
Automatic VALVES

for Engineered Protection on any **High Pressure** installation

For more than 35 years Golden-Anderson valves have successfully protected life and property by supplying safe, dependable control under even the most difficult and hard-to-handle applications.

Descriptive Technical Catalog on request

GA **GOLDEN-ANDERSON** *VALVE* Specialty Company
PITTSBURGH 22, PA.



moval of foreign matter in wash boxes, thorough rinsing, and dewatering by pressure sprays and reciprocating screens. Sizing is accomplished by patented automatic classifiers. The plant has a capacity of 450 tons an hour, the Southern Coal Co., Inc. being the distributor. The latest engineering facilities have been incorporated in the mine's design.

Establish New Oil-Shale Mining Record at Rifle, Colorado

Latest public oil-shale mining demonstrations at the Bureau of Mines at Rifle, Colorado indicated that mining costs have been further reduced from the record low levels reported previously. An average of 116 tons per man-day

A New Refractory Cement for Patch Work

In recent tests bricks—bonded together with Super No. 3000 Refractory Cement—broke when trying to pull them apart, while the joints held.

Hot or cold, thick or thin patches made with Super No. 3000 are not affected by temperatures up to 3100° F. and, being exceptionally adhesive, they hold on with a bulldog grip.

..This makes Super No. 3000 ideal for patching, wash-coating or setting brick where severe firing conditions and temperatures are found.

Get it from your supply house. Write us for Bulletin R-45.

REFRACTORY & INSULATION CORP.
118 Wall St., New York 5, N. Y.
Chicago 4, Ill. Newark 2, N. J. Philadelphia 2, Pa.

R&D Super #3000 Refractory Cement

Is this the solution to your lubrication problems, too?

FOR more than 20 years, Farval has been saving money for users. Through efficient, dependable lubrication of machines and industrial equipment of all kinds, Farval saves 4 ways: It saves oiling labor, it saves lubricant, it reduces bearing expense, it eliminates down time.

The Farval System is a positive mechanical method of delivering oil or grease under pressure to a group of bearings from one Central Station, in exact quantities, as often as desired. It consists of a central pumping unit, two main supply lines and a measuring valve for each bearing.

Catalog No. 25 and "Case Studies" give you the facts and figures. The Farval Corporation, 3253 East 80th Street, Cleveland 4, Ohio.

Write for these FREE bulletins

For personalized service: Write or phone, John E. Milliken, Cleveland exchange—Vilican 1-4500.

Invitation to a BIG BLOWOUT!

Plant operators: Celebrate the swift departure of ***Dirt, Dust,*** and ***Grit*** from your machinery and equipment. BLOW these trouble makers OUT of every crack and crevice with a powerful CLEMENTS-CADILLAC combination BLOWER-SUCTION tool. Use it regularly to clean motors, generators, switchboards, woodworking machinery, tool bins, stock bins, etc.

SAVE TIME • MONEY
PREVENT DAMAGE TO MACHINERY WITH THE . . .

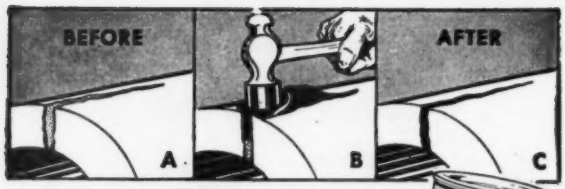
Made in 5 models with attachments for every cleaning job.

PORTABLE COMBINATION BLOWER-SUCTION CLEANER

CLEMENTS CADILLAC

CLEMENTS MFG. CO.
6628 S. NARRAGANSETT AVE. CHICAGO 38, ILL.

ASK YOUR MILL SUPPLY DEALER OR WRITE US FOR DATA



A—Deep crack. B—Tamping Smooth-On in. C—Crack completely sealed.

If You've Never Used SMOOTH-ON, *read this:*

Smooth-On No. 1 Iron Cement is a metallic powder which you mix with water to the consistency of putty. You tamp it, while still soft, into a crack or hole, making sure to force it against all surfaces. With Smooth-On you don't need to use heat or special gadgets. As it hardens, it expands slightly, clinging tightly in place. The repaired part is ready for use as soon as Smooth-On sets hard. Keep Smooth-On handy for both emergency and routine maintenance repairs. Buy it in 7 oz., 1 lb., 25 lb., or 100 lb. size. If your supply house hasn't Smooth-On No. 1, write us.

FREE 40-PAGE REPAIR HANDBOOK

Shows many industrial and home repairs made with No. 1 and other Smooth-On Cements. Leaks stopped, cracks sealed, loose parts made tight. 170 illustrations. Drop us a line for YOUR free copy.

SMOOTH-ON MFG. CO., Dept. 19
570 Communipaw Ave., Jersey City 4, N. J.

20-293

Do it with **SMOOTH-ON**
THE IRON CEMENT OF 1000 USES

"LIQUIDS WORTH STORING ARE WORTH MEASURING"

with a

LIQUIDOMETER *Tank Gauge*

- FOR GAUGING LIQUIDS OF ALL KINDS
- 100% AUTOMATIC
- APPROVED BY UNDERWRITERS' LABORATORIES

WRITE FOR COMPLETE DETAILS

THE LIQUIDOMETER CORP.
36-32 SKILLMAN AVE., LONG ISLAND CITY, N. Y.

were mined recently at a cost of 29 cents per ton. James Boyd, bureau director, has announced that credit for the record breaking performance can be credited to well-designed mechanized equipment, and improved drilling and blasting techniques developed through research. The initial record, as of September 1948, was 56 tons per man-day at a net cost of 49.7 cents per ton; the cost last summer was reported at 32.9 cents per ton. Detailed descriptions of mining operations were given in an article in the November 1949 issue of Industry and Power.

Representatives of the mining, petroleum, and equipment manufacturing industries witnessed the latest test run, from September 7 through October 4. All Diesel powered mining equipment, including the haulage trucks, were operated on Diesel fuel produced in the new refining unit at the Bureau's nearby oil-shale demonstration plant.

During the first two weeks of the run all operations were conducted on the mine's top level where five working faces were available. On this level, the direct mining cost was 31.8 cents per ton and the production was 108 tons per man day of total labor. Thirteen men were employed underground: two scalers, two drillers, one maintenance man, two blasters, one shovel operator, three truck drivers, one bulldozer operator, and a shift foreman.

In the second two weeks, mining operations were shifted to the bench or middle level. The direct cost per ton of oil shale mined through this period was 26.5 cents while the production per man day of total labor was 127 tons. Bench-level operations were staggered. The drilling and blasting crews, worked only part time, but they could keep the loading and transportation crews occupied. Drilling crews were required for only five of the ten shifts, while the blasters were needed for only three shifts. Other labor employed was the same as on the top level.

Research has shown that many opportunities exist for

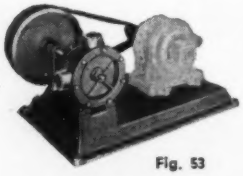


Fig. 53
STANDARD V-BELT DRIVE UNIT

For smooth, efficient handling of all types of clean liquids, there is a Viking pump built in the size and style to meet your needs.

Viking pumps are especially built for either light or heavy liquids, pressures to 200 psi, capacities from 2/3 to 1050 gpm. Ask for free bulletin 50SG.

VIKING
AN HONORED NAME IN PUMPING

See Our Catalog In SWEETS

Viking PUMP COMPANY
Cedar Falls, Iowa

still further improvements in mining shale. Four of the more promising possibilities for lowering costs are the development of a more successful rotary drill, further improvement of blasting techniques, determination of whether wider rooms could be worked safely, and the development of a continuous loading machine.

We Gladly Give Credit to . .

Industry and Power gratefully acknowledges the cooperation of the following companies and organizations in furnishing illustrations and other information for this issue:

Page 76—Chas. Pfizer and Co.
86—The V. D. Anderson Co.
87 (top)—Sarco Company, Inc.
87 (center)—Armstrong Machine Works
87 (bottom)—V. D. Anderson Co.
88 (left)—Armstrong Mach. Wks.
89 (right)—Yarnall-Waring Co.
91, 92 & 93 Photos by Elwood M. Payne, New York and Houston
101 & 102—Electrical Industrial Truck Association

In our November 1949 issue we neglected to give credit to the National Bureau of Standards for the photograph appearing in the lower left hand corner of page 107. We deeply regret this omission.

THE SILENT WATCHMAN

Dixie Tank and Bridge Co.

3523 LAMAR AVE. — P. O. BOX 14 MEMPHIS 1, TENNESSEE

Complete Service for Elevated Water Tanks
Nation Wide Service — 32 Years Experience

KEEP THE SAFETY FACTOR IN YOUR TANK THE DIXIE WAY

By welding seams, pits and rivets which gives a riveted tank 15% more Safety Factor than it had when built. No rivets removed, water supply maintained while work is in progress. On completely re-conditioned jobs, the painting is guaranteed for five years, repairs guaranteed for ten years, provided the tank is painted every five years. Yearly inspection, making all adjustments, if any, without additional cost.

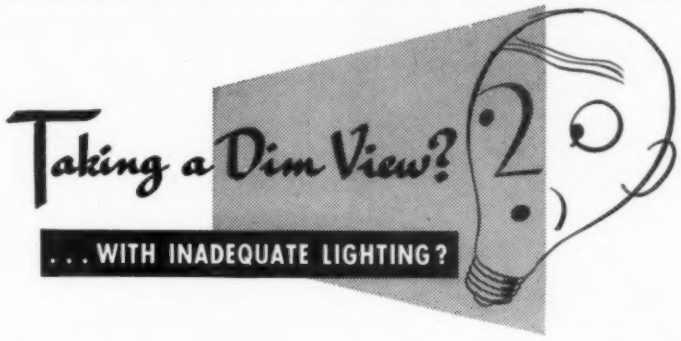
Write Us for FREE Copy of Publication

SOUND PRINCIPLES OF WATER TANK MAINTENANCE and TANK TALK, by W. A. RILEY

DIXIE'S NATION WIDE SERVICE SATISFIES

Copyright 1949

THE LARGEST ORGANIZATION OF ITS KIND GIVING SAFE MAINTENANCE AT LOW COST

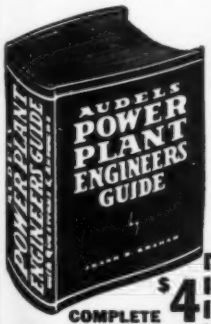


Correct illumination often means the difference between high fatigue and high production. And correct illumination requires the skill of specialists who can furnish lighting that is scientifically engineered to meet specific requirements.

Our 37 years of experience in all types of industrial and commercial illumination, both interior and exterior, plus a large staff of electrical engineers and designers is your assurance of absolute satisfaction. Call us today for consultation.

- Specialists in engineering and construction on all types of industrial and commercial power and lighting.
- Complete installations for generation, distribution, control and application of electric current.
- Athletic field and airport lighting, electronic and instrument aircraft landing systems, radio antennae, traffic signals, street lighting, etc.
- Capacity to handle any size job—from doorbell to complete power plant and system.
- Power factor correction, DC-AC conversion, motor applications, electrical heating and processing.
- Complete motor repair and inspection service—most modern, best equipped shop in Midwest.

HYRE ELECTRIC CO. 2320 OGDEN BLVD. • CHICAGO
. . . SINCE 1912 CALL CHESAPEAKE 3-6100



ENGINEERS INFORMATION ★ ★ ★
QUESTIONS and ANSWERS

JUST OUT! Audels Power Plant Engineers Guide. A complete Steam Engineers Library covering Theory, Construction & Operation of Power House Machinery including Steam Boilers, Engines, Turbines, Auxiliary Equipment, etc. 65 chapters, 1500 Pages, over 1700 Illustrations. 1001 Facts, Figures and Calculations for all Engineers, Firemen, Water Tenders, Oilers, Operators, Repairmen and Applicants for Engineer's License.

FREE TRIAL!

AUDEL, Publishers, 49 W. 23 St., New York 10
MAIL AUDELS POWER PLANT ENGINEERS GUIDE for free examination. If O. K. I will send you $1 in 7 days; then remit $1 monthly until price of $4 is paid. Otherwise I will return it.

Name
Address
Occupation
Employed by INPO

$4 COMPLETE
PAY ONLY $1 A MO.
Get this information for Yourself. Mail Coupon Today. No Obligation Unless Satisfied. ASK TO SEE IT.

COMBUSTION ENGINEERING

for power plant men . . . Become a trained combustion Engineer the easy HAYS way. Firemen, engineers, fuel and equipment men, etc., can earn bigger pay by becoming a Hays trained combustion engineer. Many employers recognize a HAYS-TRAINED engineer as a better man. Just a little of your spare time required for the simple, easy-reading Hays Home Study Course. Hundreds of others have made better jobs for themselves through Hays training. So can YOU.

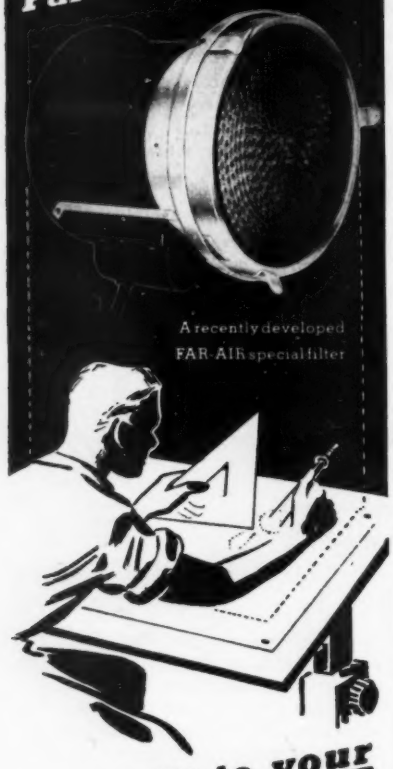
Approved for GI. *Write today for free book.*

Our 30th year. HAYS SCHOOL OF COMBUSTION
Dept. 81 430 N. Michigan Ave., Chicago 11, Ill.

HAYS SCHOOL OF COMBUSTION
Dept. 81 430 N. Michigan Ave., Chicago 11, Ill.

Name
Address
City State
Company Name

Now you can have Far-Air® Filters . . .



. . . built to your specifications!

Many manufacturers are using Farr Company's Engineering and Testing facilities to design special filters for their products. Far-Air Filters can be used effectively in your air handling equipment and will contribute to your product's performance.

They efficiently eliminate dirt, lint, grease, ink, paint, and other solid particles from the air. Sturdy construction, long service life, high performance, large dirt holding capacity, low pressure loss and easy cleaning are features that assure satisfaction.

Farr Engineers will help you to properly solve your filter requirements. Write for literature . . . FARR COMPANY, 2615 Southwest Drive, Los Angeles, California.

FAR-AIR FILTERS

*Trade Mark Reg.

"Better by Farr"

FARR COMPANY

Manufacturing Engineers

Los Angeles • Chicago • New York

ADVERTISERS' INDEX

Where an * appears after a name the advertisement does not appear in this issue, but appeared in previous issues.

Acheson Colloids Corporation 15
Aerotec Corporation, The 59
Airetool Manufacturing Company 140
Ajax Flexible Coupling Co., The ..... *
Albert Pipe Co. 161
Aldrich Pump Co. ..... *
Alemite Div., Stewart Warner Corp. .. *
Allis-Chalmers Mfg. Co. 25
American Air Filter Company, Inc. .... *
American Brass Company, The ..... *
American Brass Company, American Metal Hose Branch ..... *
American Chain & Cable Co., Inc. Wire Rope Sling Dept. ..... *
American Conveyor Co. 148
American Engineering Company ..... *
American Patent & Trade-Mark Bureau .. *
Amercican Wheelabrator & Equip Corp. .122
Ames Iron Works ..... *
Anderson-Barngrover Div., Food Mach. & Chem. Corp. ..... *
Anderson Co., The V. D. 125
Armstrong-Bray & Co. 146
Armstrong Bros. Tool Co. 128
Armstrong Machine Works 2
Arrow-Hart & Hegeman Electric Co-Motor Control, The ..... *
Atlantic Metal Hose Co., Inc. 118
Atlas Chain and Manufacturing Co. ..... *
Atlas Valve Company ..... *
Audel & Company, Theo 171

Babcock & Wilcox Co., The ..... *
Bacharach Industrial Instrument Co. .. *
Bailey Meter Company ..... *
Baldwin-Duckworth Div. Chain Belt Co. 43
Baldwin-Hill Company 63
Baltimore and Ohio Railroad ..... *
Beaumont-Birch Company 153
Beaver Pipe Tools, Inc. 147
Belmont Packing & Rubber Company, The ..... *
Betz, W. H. & L. D. ..... *
Bigelow-Liptak Corp. ..... *
Bird-Archer Co., The 62
Blaw-Knox Division of Blaw-Knox Company 168
Bonney Forge & Tool Works ..... *
Bowser, Inc. ..... *
Brady Company, W. H. 162
Breuer Elec. Mfg. Co. 164
Buffalo Forge Company ..... *
Builders Providence, Inc. Div. of Builders Iron Foundry 164
Bull Dog Electric Products Company .. *
Bussmann Mfg. Co. 40, 41
Byron Jackson Co. ..... *

Central Scientific Co. ..... *
Century Electric Co. 53
Chain Belt Co. 43
Chapman Valve Mfg. Co., The 54
Chicago Electric Company 161
Chicago Pneumatic Tool Co. ..... *
Chiksan Company 124
Clarage Fan Company 7
Clark Equipment Company 126
Clark Manufacturing Company, The .... *
Clements Mfg. Co. 169
Cleveland Worm & Gear Co. 168
Cochrane Corporation 29, 155
Coe Manufacturing Co., The 148
Combustion Control Corp. 109
Combustion Engineering-Superheater, Inc. 32, 33
Combustioneer, The Steel Products Engineering Co. ..... *
Consolidated Chimney Co. ..... *
Cook's Sons, Inc., Adam ..... *
Cooper-Pessemer Corporation, The 64
Coppus Engineering Corporation 127
C-O-Two Fire Equipment Company .... *
Crane Co. 46
Crane Packing Company ..... *

Darling Valve & Mfg. Co. ..... *
Dart Mfg. Co., E. M. ..... *
Davis Regulator Co. 130
Dearborn Chemical Co. ..... *
Deming Company, The 138
Detroit Stoker Company ..... *
Diamond Chain Co., Inc. 61
Diamond Power Specialty Co. ..... *
Dixie Tank & Bridge Co. 171
Dodge Manufacturing Corporation 55
Dracco Corporation 143
Dravo Corporation 132
Drew & Co. Inc., E. F. ..... *
Durametallic Corporation 130
Dutton Company, The C. H. ..... *

Economy Fuse and Mfg. Co. 139
Edward Valves, Inc. 22, 23
Elgin Softener Corporation ..... *
Ellison Draft Gage Co. 155
Elliott Co., Roto Div. 156
Engineer Company, The 131
Erie City Iron Works ..... *
Everlasting Valve Company ..... *

Fairbanks Company, The ..... *
Fairfield Engineering Company, The .. *
Farr Company 172
Farval Corporation 169
Fedders-Quigan Corp. ..... *
Fisher Governor Company 117
Fiske Brothers Refining Co. ..... *
Flexible Steel Lacing Company 163
Flexrock Company 162
Fluor Corp. Ltd., The 119
Fly Ash Arrestor Corp. 70
Food Machinery and Chemical Corporation ..... *
Foster Engineering Company 3
Foster Wheeler Corporation 56, 57
Fuller Company ..... *

Garlock Packing Company, The ..... *
Gates Rubber Company 50
General Coal Company ..... *
General Electric Co. (Apparatus Dept.) .. *
General Electric Co. (Appliance & Merch. Dept.) ..... *
General Electric Co. (Construction Materials Dept.) ..... *
General Fittings Co. ..... *
Gifford-Wood Co. 174
Golden-Anderson Valve Specialty Company 168
Goodyear Tire & Rubber Company .... *
Gorman-Rupp Company, The ..... *
Graver Water Conditioning Co. ..... *
Greene, Tweed & Co., Inc. 154
Grinnell Company, Inc. ..... *
Griscom-Russell Co., The 66

Haering & Co. Inc., D. W. ..... *
Harnischfeger Corporation ..... *
Hartzell Propeller Fan Co. ..... *
Hays Corporation, The 30, 149
Hays School of Combustion 171
Henszey Company ..... *
Hewitt-Robins Incorporated 151
Hills-McCanna Co. 142
Hoffman Specialty Co. ..... *
Homer Manufacturing Co. Inc., The .. *
Houghton & Co., E. F. 165
Hungerford & Terry, Inc. 160
Hyatt Bearings Division, General Motors Corp. ..... *
Hyre Electric Company 171
Hyster Company 31

Ideal Industries, Inc. ..... *
Illinois Engineering Company, Inc. ... *
Imperial Brass Mfg. Co., The ..... *
Industrial Equipment Co. ..... *
Infilco, Inc. ..... *
Ingersoll-Rand ..... *
Inland Steel Company 45
International Harvester Company 51
Invincible Vacuum Cleaner Mfg. Co. .. *
Iron Fireman Mfg. Co. 26, 27
I-T-E Circuit .....

Jefferson Electric Company ..... *
Jeffrey Manufacturing Company, The .. 52
Jenkins Bros. 8
Jerguson Gage & Valve Company 147
Johns-Manville ..... *
Johnson Corporation, The ..... *

Keckley Company, O. C. ..... *
Kewanee Boiler Corporation 134
Key Company, The 165
Kinnear Manufacturing Co., The ..... *
Kinney Manufacturing Co. ..... *
Kirk & Blum Mfg. Co., The ..... *
Kuhns Bros. Co. 166

Ladish Co. ..... *
Lamson Corporation, Allen Billmyre Division ..... *
Layne & Bowler, Inc. 157
Leslie Co. 21

ADVERTISERS' INDEX

Lima Electric Motor Co., The ..... *
Linde Air Products Company, The 42
Link-Belt Company 4
Liquidometer Corp., The 170
Livingstone Engineering Co. ..... *
Lovejoy Flexible Coupling Co. 158
Lubriplate Division, Fiske Bros. Refining Co. ..... *
Lunkenheimer Co., The 68

McAlear Mfg. Co. ..... *
Manhattan Rubber Division 13
Medart Company, The ..... *
Mercoid Corp., The 161
Metallizing Engineering Co., Inc. ..... *
Midwest Piping & Supply Co. ..... *
Milton Roy Co. ..... *
Monsanto Chemical Co. 173

National Aluminate Corporation 11
National Boiler Protector Company .... *
National Electric Coil Company ..... *
National Electric Products Corp. 34
National Supply Co. 123
New York & New Jersey Lubricant Co. .. *
Niagara Blower Company 150
Nicholson & Co., W. H. 118
Norma-Hoffman Bearings Corporation .. *
Northern Blower Company, The ..... *
Northern Equipment Co. ..... *
Nugent & Co., Inc., Wm. W. ..... *

Orr & Sembower, Inc. 120

Peabody Engineering Corp. 141
Peerless Pump Division, Food Machinery & Chemical Corp. ..... *
Pennsylvania Crusher Company ..... *
Permutit Company, The ..... *
Philadelphia Thermometer Co., The .... *
Pittston Company, The ..... *
Plibrico Jointless Firebrick Co. ..... *
Plomb Tool Company 6
Powell Co., The Wm. ..... *
Powers Regulator Co., The 167
Prat-Daniel Corporation ..... *
Precision Thermometer & Instrument Company 157
Preferred Utilities Manufacturing Corporation ..... *
Pritchard & Co., J. F. ..... *
Proto Tools 6

Raybestos-Manhattan, Inc., Manhattan Rubber Div. 13
Raybestos-Manhattan, Inc., Packing Division ..... *
Ready Power Co., The ..... *
Refractory & Insulation Corp. 169
Reliance Gauge Column Co., The 145
Remington Rand, Bookkeeping-Calculating Machine Div. 133
Research Corporation ..... *
Reznor Co. 146
Richardson Scale Company ..... *
Ric-wiL Company, The ..... *
Ridge Tool Company, The 114
Riley Stoker Corporation ..... *
Rockwell Company, W. S. 144
Rohm & Hass, The Resinous Products Div. ..... *
Ross Carrier Company, The ..... *
Roto Div., Elliott Co. 156
R-S Products Corp. ..... *
Rust-Oleum Corporation 17

Sarco Company, Inc. 113
Schramm, Inc. ..... *
Sier-Bath Gear & Pump Co., Inc. ..... *
Silent Hoist & Crane Co. 167
Simplex Valve & Meter Company ..... *
Skinner Engine Co. ..... *
SKF Industries, Inc. ..... *
Skinner Enginne Co. ..... *
Smooth-On Mfg. Co. 170
Southern Coal Company, Inc. 121
Spence Engineering Co. 18, 19
Spencer Turbine Company, The ..... *
Springfield Boiler Co. .....Third Cover
Standard Oil Company (Indiana) ..35, 36
Standard Pressed Steel Co. 162
Standard Stoker Company, Inc., The .. *
Stephens-Adamson Mfg. Co. 39
Stickle Steam Specialities Co. 137
Strong, Carlisle & Hammond Company .. *
Superior Combustion Industries, Inc. .. 49
Swartwout Company, The ..... *
Syntron Co. 158

Taylor Forge & Pipe Works ..... *
Taylor and Co., W. A. ..... *
Terry Steam Turbine Company 60
Texas Company, The .....Back Cover
Thermix Corporation, The 59
Thermobloc Division Prat-Daniel Corp. ..... *
Thomas Flexible Coupling Co. 134
Titeflex, Inc. ..... *
Todd Shipyards Corporation (Combustion Equipment Div.) ..... *
Toledo Pipe Threading Machine Co., The 44
Towmotor Corp. ..... *
Trane Company, The 136
Trerice Co., H. O. ..... *
Trico Fuse Mfg. Co. 160
Troy Engine & Machine Company 132
Trumbull Electric Manufacturing Company ..... *

Union Carbide & Carbon Corp. 42
Union Iron Works 115
U. S. Hoffman Machinery Corporation ..135
United Laboratories, Inc. ..... *

Valvair Corporation ..... *
Viking Pump Company 170
Vogt Machine Co., Henry 67

Waldron Corp., John 136
Wallace & Tiernan Products, Inc. 48
Warren Steam Pump Co., Inc. 58
Warren Webster & Co. ..... *
Weinman Pump Mfg. Company, The ..116
Weil Equipment Mfg. Company, The .. *
Wells Manufacturing Corporation 160
Western Chemical Co. ..... *
Western Precipitation Corp. ..... *
Westinghouse Electric Corporation .... *
Weston Electrical Instrument Corporation 47
Wheelco Instruments Company ..... *
Whitney Chain & Mfg. Co. ..... *
Wickes Boiler Co., The 129
Wickwire Spencer Steel Div. Colorado Fuel & Iron Corp. ..... *
Wiedeke Company, Gustav 144
Wiegand Company, Edwin L. 69
Williams Gauge Co., The ..... *
Wilson, Inc., Thomas C. 163
Wing Mfg. Co., L. J. ..... *
Worthington Pump & Machinery Corporation 111
Wright-Austin Co. 159
Wright Chemical Corporation 154

Yarnall-Waring Company 65, 128
York-Shipley ..... *

An Indication of the Products Featured by Advertisers and a list of all Advertisers of each of the following classes of products may be obtained from Readers' Guide Section. See page 20.

Boilers and Furnace Construction units
Boiler Feed Water
Compressors
Cleaners & Blowers
Diesel Power
Dust and Fly Ash Collecting Equipment
Electrical Equipment
Floor Repairs
Fuel Firing Equipment
Heat Exchangers
Heating, Ventilating and Air Conditioning
Instruments
Insulation
Lubrication
Maintenance
Material Handling
Packings & Gaskets
Pipe and Fittings
Plant Equipment
Power Transmission
Pumps
Refractories
Regulators & Controls
Steam Turbines and Engines
Tools and Small Specialties
Traps, Strainers and Separators
Valves
Welding Equipment
Wire Rope
Miscellaneous

Monsanto SANTOBRITE controls slime and algae in cooling towers

Slime and algae, enemies of good cooling tower operation, are kept under control by Santobrite (Monsanto's sodium pentachlorophenate, technical). Santobrite is economical...easy to use...efficient.

If slime and algae cause trouble in your cooling towers, it will pay you to read Monsanto Technical Bulletin No. O-15. For your copy, contact the nearest Monsanto Sales Office or write: MONSANTO CHEMICAL COMPANY, Desk A, 1743 South Second Street, St. Louis 4, Missouri.

Santobrite: Reg. U. S. Pat. Off.

DISTRICT SALES OFFICES: Birmingham, Boston, Charlotte, Chicago, Cincinnati, Cleveland, Detroit, Houston, Los Angeles, New York, Philadelphia, Portland, Ore., San Francisco, Seattle. In Canada, Monsanto (Canada) Ltd., Montreal.

MONSANTO
CHEMICALS AND PLASTICS

SERVING INDUSTRY... WHICH SERVES MANKIND

Simplification

is the KEY

TO LOWER COAL HANDLING COSTS

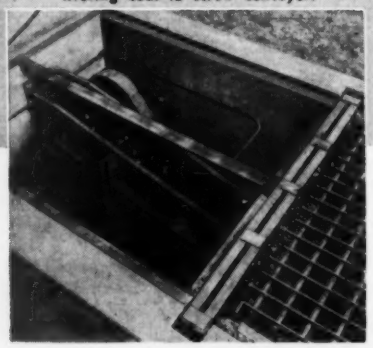
*See How G-W does it with **Four** basic designs!*

This installation at Universal Match Corporation, Hudson, N.Y., is one of **four basic types* . . . evolved by G-W to simplify design, manufacture and erection of dependable coal storage and handling equipment. G-W engineers recommend its cylindrical steel tank type of storage because it required the least amount of space and attention . . . is clean and economical to install and maintain.

Auxiliary equipment consists of feeder and conveyor from truck and track hoppers and bucket elevator to 90 ton tank at 25 tons per hour. Coal is discharged direct from storage to stoker hopper.

4 BASIC WAYS TO CUT COAL HANDLING COSTS

Showing bar feeder in hopper delivering coal to screw conveyor.



*The other three G-W basic types of coal storage systems are: reinforced concrete silo, vitrified tile silo, suspended steel bunker . . . the result of over 135 years of experience in installing hundreds of coal handling systems. Why not consult a G-W engineer? He will be glad to show you how one of these four basic designs can simplify your coal handling problems . . . reduce your costs.

4

Bulletin No. 300 describes 14 case histories utilizing these 4 G-W basic types. Write for your copy today.

GIFFORD-WOOD CO.

SINCE 1814

NEW YORK 17
420 LEXINGTON AVE.

Factory:
Hudson, N. Y.

CHICAGO 6
565 W. WASHINGTON ST.

G-W HANDLES IT . . . faster • easier • cheaper

7378